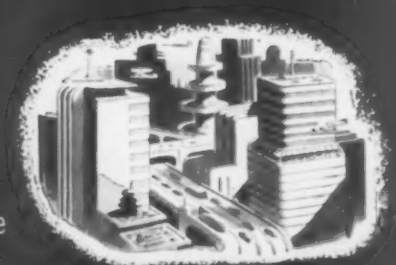
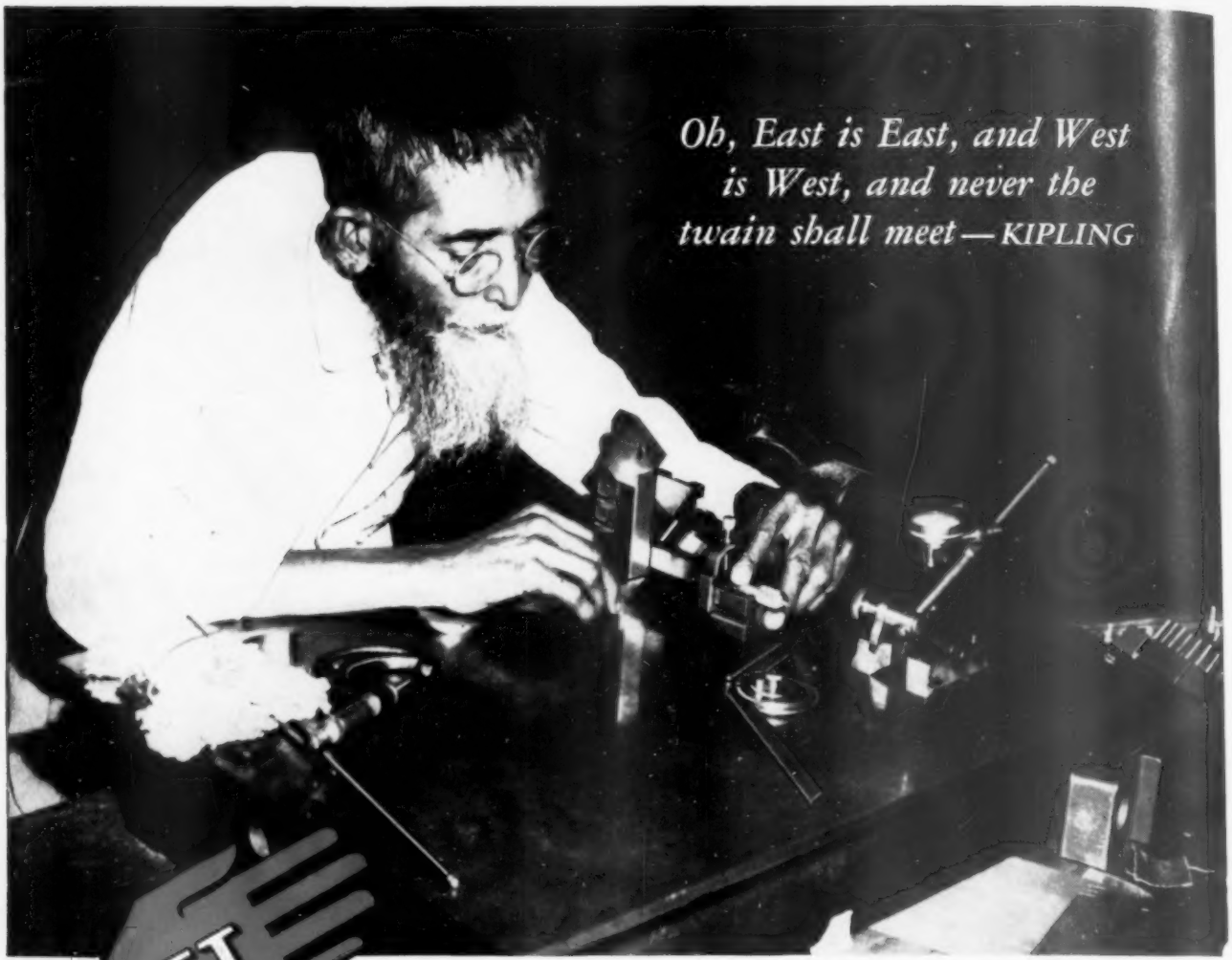
THE TOOL ENGINEER

OFFICIAL PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS



Machine Tools and Tool Engineering are the Keystone to Mass Production of War Materiel



P & W Hoke Blocks bring accuracy to India. . . . OWI Photo

MEET MOHAMED ELLAHI BUKHSH

No, Mr. Kipling, this picture was *not* taken in the modern factory of a Western industrial nation. It is India . . . a new and progressive India which is proving that East and West *can* meet, and get along famously. The workman here is Mohamed Ellahi Bukhsh, 62, an expert with precision tools in a large Indian armament plant . . . one of many such plants equipped with the finest, most up-to-date American machines and tools.

Here, though halfway around the world in a country taking its first industrial "steps," accuracy is not a hit-or-miss proposition. For example, here on the job with Mohamed Bukhsh are the familiar Pratt & Whitney Hoke Precision Gage Blocks, a basic, unchanging standard of measurement guaranteed to be accurate within five millionths of an inch.

Today, there are no geographical limits for accuracy. Mohamed Ellahi Bukhsh and thousands of newly-skilled workers like him all over the world are daily depending on Pratt & Whitney machine tools, small tools, and gages—on P&W's 84-year background as masters of *basic accuracy for mass production*. They are discovering what Western manufacturers have known for years—that Pratt & Whitney products are built to one rigid standard of accuracy which never changes.

PRATT & WHITNEY

Division Niles-Bement-Pond Company

WEST HARTFORD 1, CONNECTICUT

Get Extreme Accuracy, High Spindle Speeds and Ease of Operation with this HARDINGE Second Operation Machine

CAPACITY:
$\frac{1}{16}$" to 1" with collets
1" to 6" with step chucks
1" to 5" with jaw chucks
Spindle Speeds:
100 to 4000 r.p.m.

The combination of extreme accuracy, high spindle speeds and ease of operation means better results under the close tolerances of manufacturing standards both today and in the days to come. The ease and simplicity of operation enables relatively unskilled operators to produce parts to the necessary close limits without expensive tooling.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

Again-

DOUBLED PRICES on SUPER Milling Cutters

SUPER has done it again! For the second time in less than a year, prices on Super Carbide Tipped Milling Cutters have been reduced! And it is a big reduction, too . . . again made possible because of an increased demand for these fast, economical cutters that has resulted in increased production and greater manufacturing economies. Take a look at the new low prices shown in the charts at the right . . . then phone your order TODAY for these Super Carbide Tipped Milling Cutters that now, more than ever, will step down your costs while they are stepping up your production.

SPECIFICATIONS AND PRICES

Cutters for Cast Iron, Brass, Bronze, Aluminum, Etc.

Tool Order No.	Diameter	Width	Hole	No. of Teeth	Price Each
3-GP-1	3"	1/4"	1"	4	$ 9.75
3-GP-2	3"	5/16"	1"	4	9.75
3-GP-3	3"	3/8"	1"	4	10.00
3-GP-4	3"	7/16"	1"	4	11.00
3-GP-5	3"	1/2"	1"	4	12.00
4-GP-1	4"	1/4"	1"	4	12.00
4-GP-2	4"	5/16"	1"	4	12.00
4-GP-3	4"	3/8"	1" or 1 1/4"	4	12.25
4-GP-4	4"	7/16"	1"	4	13.00
4-GP-5	4"	1/2"	1" or 1 1/4	4	13.50
4-GP-6	4"	9/16"	1"	4	15.00
4-GP-7	4"	5/8"	1" or 1 1/4"	4	16.00
4-GP-8	4"	3/4"	1" or 1 1/4	4	17.00
4-GP-9	4"	7/8"	1" or 1 1/4"	4	25.00
5-GP-4	5"	7/16"	1 1/4"	6	17.25
5-GP-5	5"	1/2"	1" or 1 1/4	6	17.50
5-GP-6	5"	9/16"	1 1/4"	6	18.00
5-GP-7	5"	5/8"	1 1/4"	6	18.25
5-GP-8	5"	3/4"	1" or 1 1/4"	6	20.50
5-GP-10	5"	1"	1 1/4"	6	27.50
6-GP-5	6"	1/2"	1" or 1 1/4"	6	21.00
6-GP-7	6"	5/8"	1 1/4"	6	22.00
6-GP-8	6"	3/4"	1" or 1 1/4"	6	26.00
6-GP-10	6"	1"	1 1/4"	6	30.00
7-GP-8	7"	3/4"	1 1/4"	8	30.00
7-GP-10	7"	1"	1 1/4"	8	33.00
8-GP-8	8"	3/4"	1 1/4" or 1 1/2"	8	35.00
8-GP-10	8"	1"	1 1/4" or 1 1/2"	8	38.50

SPECIFICATIONS AND PRICES

Cutters for Use in Steel

Tool Order No.	Diameter	Width	Hole	No. of Teeth	Price Each
3-ST-1	3"	1/4"	1"	6	$14.00
3-ST-2	3"	5/16"	1"	6	14.00
3-ST-3	3"	3/8"	1"	6	14.25
3-ST-4	3"	7/16"	1"	6	15.50
3-ST-5	3"	1/2"	1"	6	16.25
4-ST-1	4"	1/4"	1"	8	17.00
4-ST-2	4"	5/16"	1"	8	17.75
4-ST-3	4"	3/8"	1" or 1 1/4"	8	18.25
4-ST-4	4"	7/16"	1"	8	18.75
4-ST-5	4"	1/2"	1" or 1 1/4"	8	19.50
4-ST-6	4"	9/16"	1"	8	20.75
4-ST-7	4"	5/8"	1" or 1 1/4	8	21.50
4-ST-8	4"	3/4"	1" or 1 1/4"	8	22.00
4-ST-9	4"	7/8"	1" or 1 1/4"	8	30.00
5-ST-4	5"	7/16"	1 1/4"	10	22.50
5-ST-5	5"	1/2"	1" or 1 1/4"	10	23.00
5-ST-6	5"	9/16"	1 1/4"	10	25.50
5-ST-7	5"	5/8"	1 1/4"	10	26.50
5-ST-8	5"	3/4"	1" or 1 1/4"	10	30.00
5-ST-10	5"	1"	1 1/4"	10	35.00
6-ST-5	6"	1/2"	1" or 1 1/4"	12	33.75
6-ST-7	6"	5/8"	1 1/4"	12	35.00
6-ST-8	6"	3/4"	1" or 1 1/4	12	37.00
6-ST-10	6"	1"	1 1/4"	12	40.00
7-ST-8	7"	3/4"	1 1/4"	12	39.00
7-ST-10	7"	1"	1 1/4"	12	45.00
8-ST-8	8"	3/4"	1 1/4" or 1 1/2"	12	40.00
8-ST-10	8"	1"	1 1/4" or 1 1/2"	12	50.00

Variations from above specifications subject to special quotation.

SUPER TOOL COMPANY

Carbide Tipped Tools

PUBLISHED MONTHLY BY

THE TOOL ENGINEER

AMERICAN SOCIETY OF TOOL ENGINEERS

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Hydraulic Systems Applied To Machine Design.
An authoritative article on hydraulic pressure units, circuits and controls and their application to special and automatic production tools.

Proposed: A Classification Standard For Sintered Carbide Cutting Tools.
Designed to aid the ultimate consumer in the selection of grades for cutting various materials.

The Junior College
Short illustrated "talks" on the principles of various techniques of mass manufacture.

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The VULCAN TOOL Co.

213 NORTH BECKEL STREET DAYTON 3 OHIO

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MACHINE DESIGNERS CAN TAKE A TIP FROM THE USE OF OILGEAR TRANSMISSIONS IN AMERICA'S NEWEST, MOST EFFECTIVE ANTI-AIRCRAFT GUN

A typical example of the almost unlimited flexibility of Oilgear Fluid Power, the things you can do with it, is the highly successful use of Oilgear Transmissions in America's newest and most effective 40 M M anti-aircraft guns. Two Oilgear Transmissions serve each gun. One moves the carriage from side to side, the other elevates the gun muzzle. The two transmissions are self-synchronizing and work automatically on signals from the director-mechanism. Enemy planes may come in from any direction, at tree-top level as well as at great heights. Hence, these Oilgear Transmissions provide rapid slewing and elevating speeds with precise, rapid and accurate deceleration as the gun centers on the target, and appropriate following speed. Plane evasive tactics are met by variable synchronization of the two directions of travel. Easy and speedy disengagement and re-engagement of automatic operation is also provided. These Oilgear transmissions are small, powerful, dependable.

In the functions outlined above, or elsewhere in the wide range of characteristics of Oilgear Fluid Power you are almost certain to find a better solution to the problem that confronts you. Write for further information or put your problem up to Oilgear Engineers. Do it *now*. . . . THE OILGEAR COMPANY, 1308 West Bruce Street, Milwaukee 4, Wisconsin.

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1. Apply large forces through long . . . or short . . . strokes at variable speeds?
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SPECIALISTS FOR OVER 50 YEARS IN

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This manufacturer solved the difficulties involved in milling irregular shapes in cylindrical parts by placing the job on a Gorton Tracer-Controlled Pantograph, equipped with a Gorton Roll Attachment, enabling use of only a simple, FLAT Master.

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PART—Valve.
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ATTACHMENT—Gorton Roll Attachment 750-1.
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PRODUCTION—30 minutes per Valve, floor-to-floor.
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The *Right* Size The *Right* Type of Machine for Every Job . . .
From 2 oz. to 2 ton DIE BLOCKS

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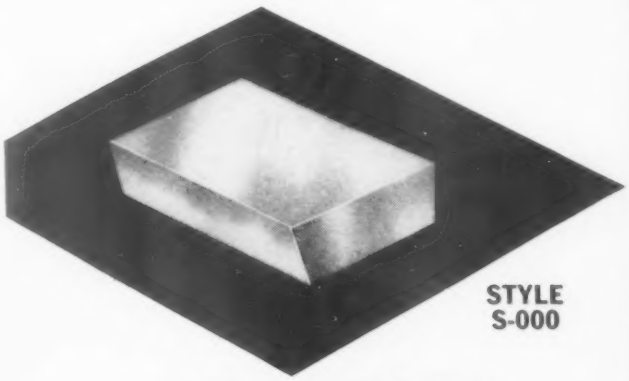
New KENNAMETAL *"Universal"* BLANKS



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FACILITATE TOOL MAKING

and Keep Stocks Down!

These new Kennametal "Universal" tool blanks are literally "jacks-of-all-trades." Rectangular in shape, with 12° clearance angle formed on one long edge, they can be used to make many different types of tools, simply by setting them into open-end recesses, as illustrated. They are available in all recognized standard sizes, many of which are stocked in several grades.

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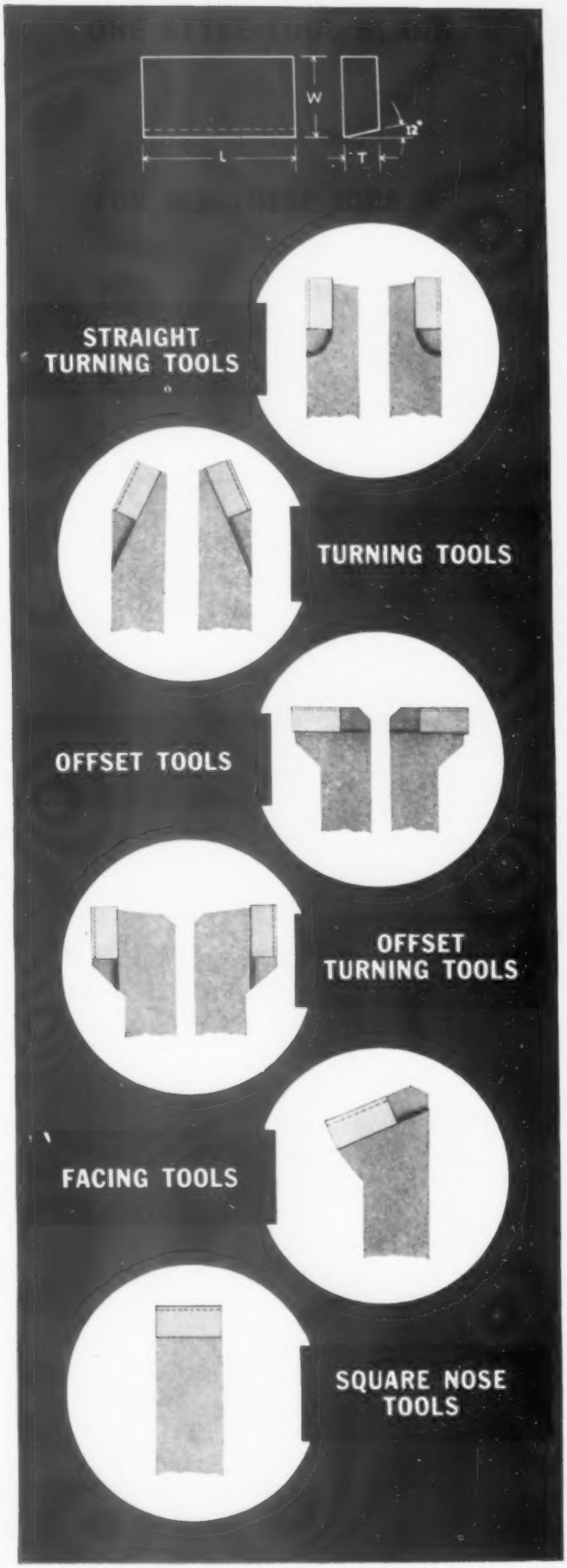
Catalog particulars, and prices, are yours for the asking.

KENNAMETAL

SUPERIOR CEMENTED CARBIDES

KENNAMETAL Inc., LATROBE, PA.



Double THE PIECES PER GRIND

with LATROBE RED ARROW

The Superior Cast Alloy
-for metal cutting tools

- Requires no heat treatment
- Easily brazed to tool body
- Ground with ordinary wheels
- Standard sizes of tool bits in warehouse stocks

More production per grind was a particularly important goal in this case because the parts were for essential war material and vitally needed!

The high speed form tools ran a full shift without regrinding but in order to maintain the required accuracy and high surface finish it was necessary to regrind the super high-speed end-facing tool every four hours, resulting in thirty minutes shut down. The substitution of a Latrobe *Red Arrow* facing tool doubled the pieces per grind and enabled the set-up to run one whole shift before regrinding was necessary.

Even though machining speeds are set for high speed tools, it will pay you to use Latrobe *Red Arrow* for "critical" tools in such machining operations.

Write for special bulletin!

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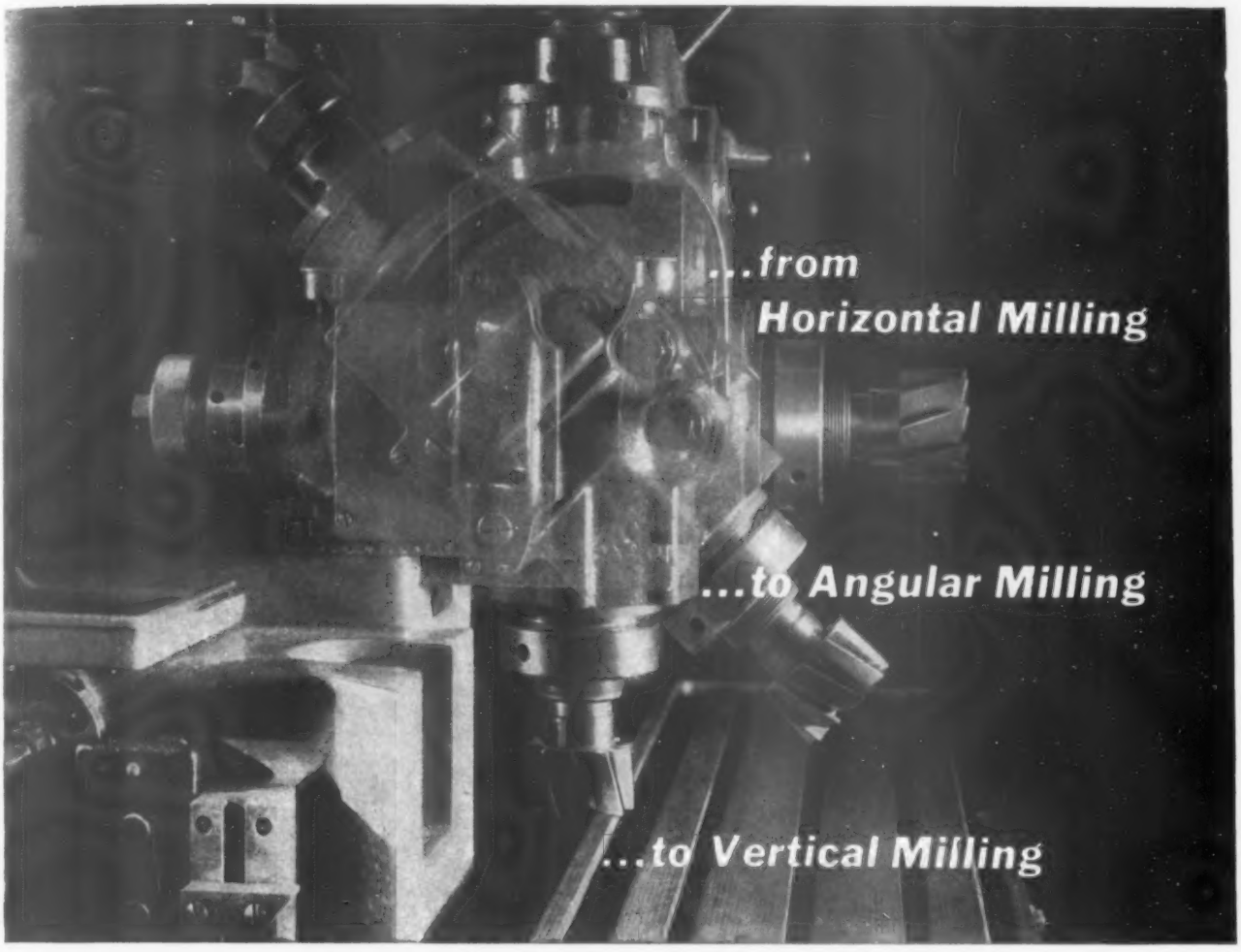
MAIN OFFICES *and* PLANT · · LATROBE · PENNSYLVANIA

R-1

Quick Changes on Van Norman

RAM-TYPE MILLING MACHINES



When the operator has completed a horizontal cut on a Van Norman Ram-Type Miller, and wishes to proceed to an angular or vertical cut . . . *he does not need to touch the set-up on the table.* All he has to do is unclamp the swiveling cutterhead, swing it to the required position, reclamp . . . *and start the next cut.* Only a matter of moments, compared with the time needed to reset the work. And one of the greatest sources of errors is completely avoided. This exceptional ease and convenience of operation provide gains in time, accuracy and output. So today, throughout America's war industries, Van Norman Ram-Type Millers are delivering the goods in great plenty . . . and in plenty of time.

VAN NORMAN
Company

ARMY E NAVY

SPRINGFIELD 7, MASSACHUSETTS

WHAT IS
"Plunge Forming" or Crush Dressing
OF GRINDING WHEELS?

Is Crush Dressing New?

Yes and no—it is relatively new "over here" for general commercial use, but it has been standard practice in other countries for some time.

Who Introduced It Commercially to the U. S. A.?

Knowing of this practice, representatives of the Sheffield Corporation, Dayton, Ohio, visited England in 1939 to investigate crush dressing. So impressed was Sheffield with the possibilities that patent and manufacturing rights were obtained for producing this equipment in America. A few weeks later an English concern placed an order with Sheffield for a large number of thread grinders especially designed for the crush method of wheel dressing.

What was the First Commercial Machine to be Produced in the U. S. A. Using Crushed Wheel Dressing?

The Precision Thread and Form Grinder was designed, manufactured, and sold by The Sheffield Corporation of Dayton, builders of gage thread grinders for thread gage production since the first World War. This new machine tool is equally proficient in producing precision threads or forms (regular and irregular) from a crush dressed wheel.

What is Crush Dressing?

Crush dressing is the process of using hardened steel rolls to form or dress grinding wheels to a wide variety of shapes which in turn can be transferred to the work part.

How is the Crusher Roll Produced?

The same form that is to be crushed into the wheel is ground into a hardened steel roll approximately three inches in diameter by the use of the Sheffield Micro-Form Grinder. The profile is reproduced directly from a drawing. A pantograph positions a microscope to guide the operator in feeding the grinding wheel into the steel roll to an accuracy of .0003".

Original crusher rolls for threaded parts are produced on the Sheffield Precision Thread and Form Grinder by using a single point wheel.

Many additional crusher rolls for either forms or threads can be reproduced quickly and at minimum cost by using crush dressed wheels on the Sheffield Thread and Form Grinder.

Can the Wheels of Surface Grinders be Crushed Dressed?

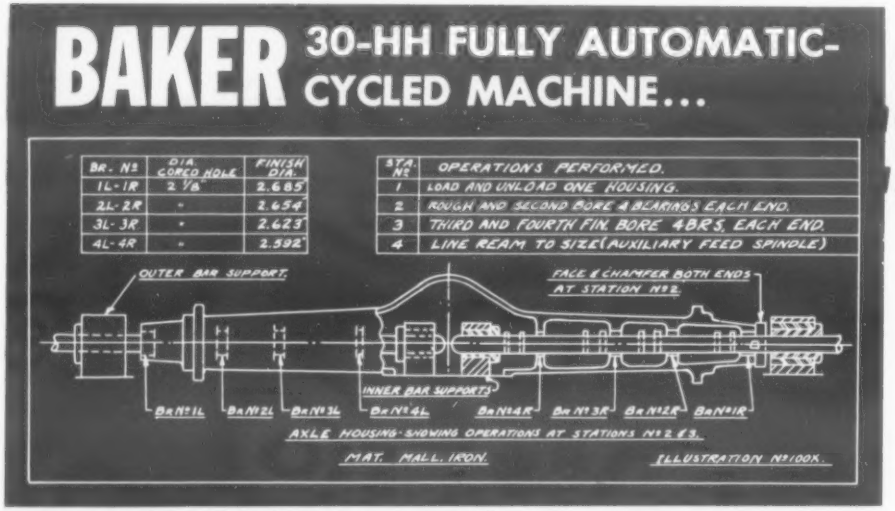
Yes, they can. At the same time the Sheffield Corporation pioneered the commercial use of crush dressing for producing circular forms and threads, it also pioneered the use of this method for dressing surface grinder wheels and the development of standard mountings for crusher rolls on surface grinders. Sheffield has unmatched research and commercial experience in crush dressing for surface grinding and has counselled with many plants making critical war materials on the solution of production problems by crush dressing.

Where Can More Detailed Information on Crush Dressing be Obtained?

Full information on crush dressing, production of crusher rolls for surface grinders, the Precision Thread and Form Grinder especially developed for crush dressing, and the Micro-Form Grinder for producing crusher rolls, can be obtained from The Sheffield Corporation, Dayton 1, Ohio, U.S.A. Engineering data will be forwarded promptly.

ADVERTISEMENT OF THE SHEFFIELD CORPORATION

BAKER 30-HH FULLY AUTOMATIC-CYCLED MACHINE...



...elps speed wartime War Production today, ...ssures Quick Conversion when peace comes!

Specially furnished for multiple operations on malleable iron Axle Housings for Trucks, this Baker 30-HH Hydraulic Feed Two-Unit Two-Way Horizontal Machine is a real "producer" of vital war goods, and a sure profit-maker for post-war civilian production! Its flexibility and versatility are the features that guarantee a quick change-over as soon as re-conversion begins. The fully automatic cycle results in considerably higher production than could be achieved by conventional methods . . . also greatly reduces the human element and minimizes operator fatigue.

Much Higher Production assured by Fully Automatic Operation —

At each machine cycle, one Axle Housing is completed with four cuts in each of the four bearings at each end of Axle Housing, in addition to final reaming-to-size operation at last cutting station. The two spindles at each opposed head on main saddle of hydraulic feed unit are used for operations at Stations 2 and 3. At last cutting station, each opposed head is furnished with independent auxiliary long-travel spindle carrying multiple-blade reamer head for each one of four bearings at each end of housing. Machine is fully automatic with electrical inter-locks. Bars at Stations 2 and 3 move into cutting position stationary, non-revolving—to allow inside cutters through previous bores. Note slight difference in finished diameters on each bore (see table above). Bars move into Axle Housing to cutting position with Housing indexed slightly off working position. When bars are in position, trunnion is carried into actual true cutting position, and bars automatically start in rotation and automatically engage into feed. At end of cut, automatic trip and fully automatic cycle reverse the starting cycle. Production is considerably higher than where operator of single-spindle machine has to insert each bar through bores, then start machine.

BAKER BROS.. INC. • TOLEDO 1C, OHIO

SINGLE AND MULTIPLE SPINDLE MACHINES FOR DRILLING, BORING, FACING, TAPPING, REAMING

NOW IT MUST BE TOLD!

WHEN partners of long standing agree to sever relationships, the dissolution is usually accomplished on an agreeable basis and complete friendliness and mutual good will remain. Reports reaching us from members and others, substantiated by published announcements, lead us to believe that, in some fashion, misleading information concerning your Society's publication, "The Tool Engineer," is being disseminated. Following are the facts:

1. In 1935, your Society made an agreement with a commercial publisher,
   a. by which he was to publish the "official publication of the American Society of Tool Engineers," known as "The Tool Engineer," in the "interests of its members" and was to furnish the magazine to all bona fide members each month without charge;
   b. under which he received any and all profit arising from the publishing activity, whether derived from the sale of advertising space or otherwise;
   c. and, in which it was established that "an ideal arrangement is fifty (50%) per cent editorial and fifty (50%) per cent advertising" (anything other than advertising is termed "editorial material");
   d. subject to editorial guidance and supervision by the Society, through its Editorial Committee, and solicitation of editorial material presumably to be made through that Committee which has representatives in each Chapter;
   e. the term of the contract set at five (5) years and *renewable at the sole option of the commercial publisher for succeeding terms of five (5) years each,* simply by a written expression from him of his intent to renew, six (6) months prior to the current expiration date. No cancellation by the Society was possible and ratification of a renewal by the Board of Directors was entirely without meaning or force.
2. The contract was renewed by the commercial publisher, exercising his option, in 1940. The effective term of that renewal expired January 28, 1945.
3. On July 20, 1944, the commercial publisher notified President Burnside that he would not renew the contract "in its present form"—BUT—suggested a new contract or amendments to the existing contract for making minor adjustments.
4. The Executive Committee having, under date of May 27, 1944, expressed its unanimous approval of the "Tool Engineer" operations by the commercial publisher and its unanimous statement of desire to have him renew his contract, thereupon invited him to submit an outline of his wishes for the contents of a new contract or amendments to the existing contract.
5. Then followed conferences between the commercial publisher, his representatives, and his attorney with the Second Vice-President of the Society and our attorney.
6. At a meeting of the National Executive Committee at St. Louis, August 19th, 1944, our attorney read and presented the "Amendment and Supplement to agreement between the American Society of Tool Engineers and—" submitted by the commercial publisher. This contained provisions entirely at variance with those understood to be agreed upon by the Society representatives at the above mentioned conferences.
   It was impossible to accept some of these provisions.
   a. One provision gave the commercial publisher the right to discontinue the title, "The Tool Engineer," *at any time at his option* and prevented the Society from permitting the use of the name by any other publication whatsoever, prior to the termination of the agreement or any renewal thereof.
   b. One provision called for a three (3) year term, renewable by and at the option of the commercial publisher only, to the extent of not more than twenty-five (25) years.
   c. One provision limited the *entire right and interest* of the Society in the magazine to ownership of the title, "The Tool Engineer," and gave sole control of *content, size,* and *form* of the publication to the commercial publisher.
   d. One provision limited the commercial publisher's obligations to furnish copies to members (that is, addressees designated by the Society) to a total not exceeding the greatest number heretofore furnished in any one month and this provision would hold until *all* paper restrictions are removed and paper "in unlimited quantity becomes available to Second Party," that is, the commercial publisher, but permitted the commercial publisher to continue to send copies to approximately four thousand (4,000) non-members of his own choosing each month. Thus, new members of the Society could receive the magazine only if present members died or resigned.
7. On September 16, 1944, in a long distance telephone conversation, initiated by the commercial publisher, President Burnside advised him that the Society, represented by the Executive Committee, found the terms of the proposal not acceptable, and learned from the commercial publisher that he was unwilling to amend or compromise any of the suggested provisions.
8. Under date of September 18, 1944, the following commercial publisher announcement appeared, "We are pleased to be able to announce that beginning with the next February issue our publication, long known as 'The Tool Engineer,' will come to you with a new title—PRODUCTION ENGINEERING & MANAGEMENT"—and a second statement — "Announcing: A Change In Title From The Tool Engineer to Production Engineering & Management, effective with our February, 1945, issue."

   Under date of October 27, 1944, the following appeared, "Effective February, 1945, issue, the Bramson Publication—long known as The Tool Engineer will be entitled—Production Engineering & Management" and a second statement—"Effective February, 1945, issue, The Tool Engineer will be known as Production Engineering & Management."

   Under date of December 1, 1944, the following appeared, "File for future reference—Production Engineering & Management, published for 10 years by The Bramson Publishing Company as The Tool Engineer"—and a second statement—"We have advised you several times heretofore of our change in title *from The Tool Engineer to* PRODUCTION ENGINEERING & MANAGEMENT."

   Under date of December 9th, 1944, the first blurb, listed under date of October 27th, was repeated.
9. Obviously, a strong effort has been made to convince readers that the "Tool Engineer" is going out of business. Some trade publications were successfully misled and published information that the "Tool Engineer" would no longer exist. One such publication is "Printer's Ink"—see issue of September 29, 1944.
10. Actually, plans and organization are completed and every effort is being made to produce a better "Tool Engineer" which will more nearly attain the goals originally contemplated and desired by all of us, with a more extensive editorial content than heretofore and an editorial spirit alert to trends in our field.
11. The interest and response of advertisers indicates their confidence in the Society and their desire to advise our members of the new developments in our field of activity.

These are the facts without reference to the background which led to the inevitable severance of business relationships. If additional information on this matter is desired, do not hesitate to ask National Headquarters for it.

AMERICAN SOCIETY OF TOOL ENGINEERS
D. D. Burnside, National President

By Frank W. Curtis

Tooling for Induction

- ***This ultra modern technique, though still in its infancy, effects marked economies in mass production and promises to revolutionize the manufacture of complex parts***

HIGH-FREQUENCY induction heating as applied to its wide variety of industrial uses is closely related to the activities of the tool engineer, because the equipment involved is a production tool that requires the design of heating coils and fixtures to assure successful application.

Whether brazing, hardening, or other forms of heating operations are being considered, there usually are metal parts to be handled, either in large or small quantities, and the success of the setup is largely dependent on the effectiveness of the tooling used.

Tool engineering also covers process planning and the sequence of operations required to complete a given part. Therefore, since induction heating often bears a direct relation to processing methods, it is obvious that the tool engineer should have a broad knowledge of what can and cannot be expected of induction heating, so that he will be in a position to consider its use as a means of establishing manufacturing economies, in all cases where it can be applied.

Induction heating as a process combines three basic considerations; electrical, metallurgical and mechanical. The generation of the current is an electrical phenomena, only understood in a limited way by the average user. The electrical considerations are important, but usually they resolve themselves to a knowledge of application requirements. A broad understanding of the whys and wherefores of producing high-frequency current is not paramount, as far as operation is concerned. However, the availability of an electrical technician for consultation on such problems that require explanation, is helpful.

***Frank W. Curtis*, long active in the A.S.T.E. and its former National President (1941-42), is Consulting Engineer for the Induction Heating Corp., Springfield, Mass. He has had many years of tool and production engineering and product design experience, and is author of a book, "High Frequency Induction Heating," published recently.**

Has Broad Application

The metallurgical aspect, as in any other heating operation, is important. Analysis of results must be checked, whether brazing, hardening, or other forms of heating are applied. Yet, as in the case of the electrical needs, the metallurgical control is secondary to the consideration of production techniques. When summed up, therefore, the productivity of an induction-heating unit is really determined by the ingenuity of the tooling, including coils, feeding devices and fixtures, which means that the mechanical consideration becomes the most important phase of operation. It is here that the field of tool engineering plays an important part.

Induction heating is used for various industrial applications where metal requires heating, such as for soldering and brazing, hardening, drawing, annealing, forging, melting, fusing, expanding, stress relieving, tempering and debonding. Its principal uses, however, are for the joining of metal assemblies, and for the localized hardening of steel parts, used in mechanical assemblies. As in all processes, however, induction heating is selective in its field and is not a cure-all intended to supersede other forms of heating equipment. Usually, where induction heating can be applied, it has distinct advantages over other methods. In some cases, difficult heating operations can be carried out with ease. There are also cases where induction heating performs operation that can be handled in no other way. The chief problem, therefore, in considering induction heating is to determine its scope of application and where the dividing line takes place.

A variety of metal parts suited to induction is illustrated in Fig. 1. At *A* is shown an assembly comprising a steel flange and tube, requiring joining by brazing. This is a very common type of operation handled effectively by placing a ring of brazing alloy around the tube as shown, and then locally heating the area to be joined. When proper temperature is reached, the alloy flows throughout the sheer area, resulting in a uniform, strong joint. For this type of setup, a wide range of sizes can be considered, with smaller assemblies lending themselves to multiple loading, and larger parts, where more mass is encountered, to single handling.

At *B* is illustrated a condenser can, requiring the soldering of a cover to the body. A ring of preformed solder wire is placed on the inside of the body, on the cover, then the assembly is placed in a high-frequency field so that only the joint section is heated. Operations of this type can often be handled by a conveyor setup in which the work passes under the heating coil. Output up to 2,000 or 3,000 pieces hourly can be obtained for the smaller sized cans, with proportionate quantities for the larger sizes.

Heat Controlled and Localized

The brazing of tungsten carbide tools, as at *C*, is another outstanding application of induction heating, inasmuch as heat can be localized to the joint areas in a few seconds, resulting in a firm, solid bond. The example at *D* represents a clutch gear, requiring hardening on both the gear teeth and clutch teeth. Parts of this type can be surface heated very effectively by means of induction heat, followed by a spray quench, with practically no distortion and with the elimination of the usual scale that results from other means of heating. The cam at *E* can be surface hardened on the angular face, without the usual deformation to which such shapes are so often subjected. Induction heat also finds a field in connection with shrink fits, such as at *F*, in which the flange is heated prior to assembly to the tube. The heating of slugs for forging, such as shown at *G*, is still another use for induction heat, very often lending itself to progressive handling mechanisms. Similarly, long shafts can be progressively hardened by passing the work through a short coil, concentrating heat to a small area at a time, which in turn can be either spray quenched or immersed into a tank as it leaves the heating zone. Small carbon tools such as taps, reamers, blades, and other cutters, can also be hardened by induction heat.

The bevel gear assembly, at *H*, includes a gear and hollow shaft, which first are joined by brazing, then followed by a selective hardening operation for the teeth. Since the induced

Heating . . .

at is localized to the teeth only, the previously brazed area unaffected as a result of hardening. Assemblies such as that I can be fused together, and long shafts, as at *K*, can have aring surfaces selectively hardened without metallurgically ffecting the untreated portions. At *L* is shown a combination brazing and hardening treatment. The steel disc is assembled to the flanged tube with a ring of alloy on the inside oint as shown. A heating coil is made so that the current s induced to the face of the disc as well as the joint area, arranged so that the heat rise is properly proportioned, being greater at the surface requiring hardening. At the end of the heat cycle, when the alloy has melted, a spray quench is applied to the face of the disc completing the hardening of the desired surface. These examples are but a few of the many uses to which induction heating can be applied but will offer a general idea of the field covered.

Productive and Economical

The three basic advantages of induction heating are economical heating, high production and uniform results. The economy in heating usually results from the ability to apply localized heat to a specific area of a part or assembly, rather than to heat the entire unit. When this is possible, no heat is wasted and as a rule the operation can be handled very quickly, often in a matter of seconds, so that productivity is relatively high, and the direct savings a factor of importance. With such setups, indirect economies also prevail, such as the elimination of scale, and the reduction or absence of deformation, which in themselves might overshadow the direct savings. On the other hand, if a part requires heating throughout it might well be outside the inductive heating field and lend itself more favorably to other methods.

Uniformity of heating by the inductive method is made possible through automatic timers, offering split-second control. As a result, the human element is removed to a great extent and spoilage is reduced or eliminated. Parts can be processed individually, or in series, or even progressively by means of conveyors or hoppers, depending upon their nature and to the extent to which the tooling is provided. Either small or large-lot runs can be considered so that induction heating equipment can be used as a machine in the production line or as a general-purpose heating unit.

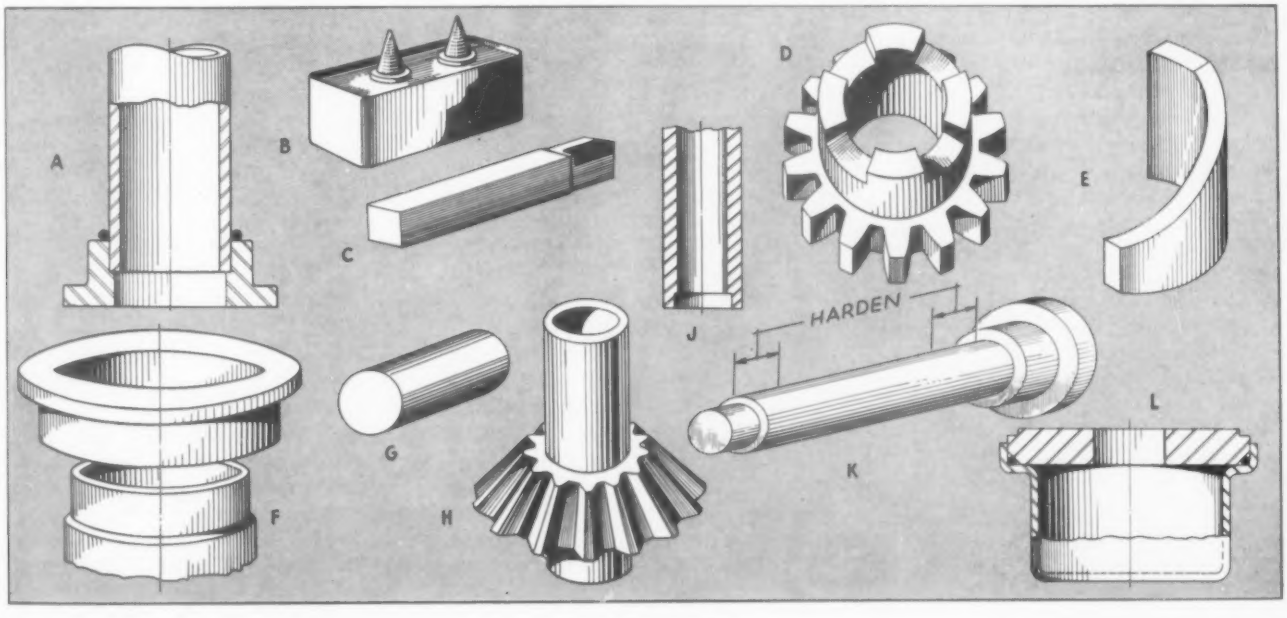
MATERIAL	SPECIFIC HEAT	RELATIVE RESISTANCE	RELATIVE CONDUCTANCE
Aluminum	.213	2.80	63%
Brass	.090	7.00	27
Copper	.092	1.72	100
Iron, Pure	.108	10.00	17
Lead	.031	22.00	8
Nickel	.118	7.10	22
Platinum	.031	10.20	17
Silver	.063	1.62	106
Steel, Av.	.150	10.15	14
Tin	.057	11.90	15
Tungsten	.032	5.70	32
Zinc	.095	5.80	36

TABLE: Physical characteristics of metals showing the constants most usually required in connection with induction heating.

Heating coils for the transfer of high-frequency current to the surface of metal parts can be made in an endless variety of shapes, styles and sizes, of which representative designs are illustrated in Fig. 2. The two basic types are those made of tubing and wound into the shape desired, and those of the solid type made of copper bus bar or flat plates, often termed single-turn inductors. Either of these can be made singly or in series for multiple handling. Pure copper, having a high conductivity, not less than 90 per cent, should always be used for the construction of all heating coils in order to assure the most effective results.

The coil at *A* is a multiple-turn copper tube coil, arranged with leads that provide for quick-change requirements where only a few pieces may be treated at one time. Such can be wound square, tapered, or to almost any irregular shape to suit the contour of the part requiring heating. The coil at *B* is a multi-turn pancake design for surface treating, while at *C* is also shown a flat coil of built-up design, such as would be used for the heating of clutch teeth. At *D* is a solid coil

FIG. 1. Typical variety of metal parts which require heating, of one form or another, suited to the induction process for treatment.



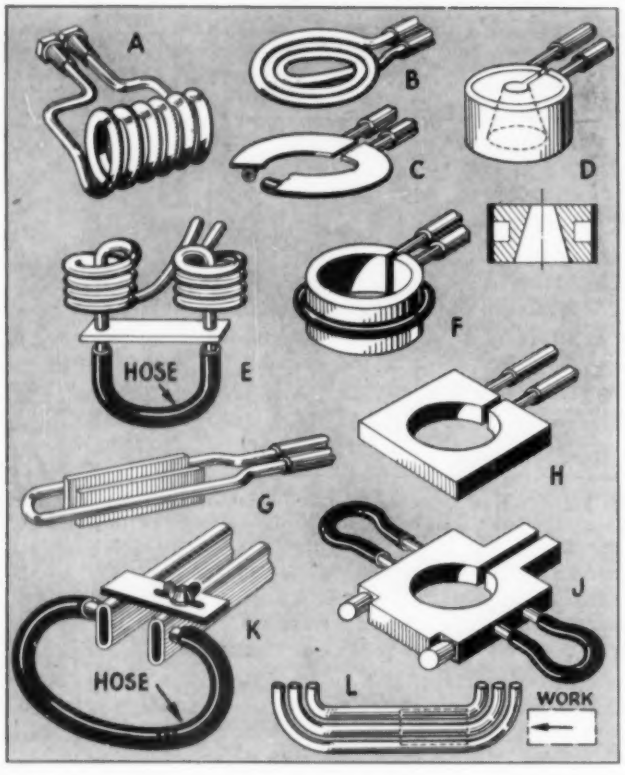


FIG. 2. Various styles of heating coils, made from copper tubing or plates, as used for hardening, brazing and soldering of metal components.

for a tapered surface. This design, for example, could be used for the hardening of a lathe center, permitting the quench to be passed through the coil after the heating cycle has been completed. A series type multi-turn coil is illustrated at *E*, showing the use of a jumper for conducting the current from one coil to the other, and a hose connection for the continuous passage of the cooling water. The coil at *F* is a built-up design, including a copper tube brazed around a sleeve. At *G* is a single loop coil of the hairpin type with flat strips attached to offer a wider concentration of flux to metallic parts placed between them. The solid coil at *H* is representative of a one-piece inductor, made with integral cooling passages for the flow of water, passing through the leads.

Typical Production Tools

At *J* is shown a spit coil of the solid type, as might be used for brazing an assembly having flanges on each side of the surface requiring heating. The coil is provided with internal cooling passages, hose connections between sections, and studs with knurled nuts for aligning and fastening. At *K* is an adjustable-type coil, such as may be used for conveyor setups, made of two sections of flattened tubing. The ends are sealed and small tubes are joined at the sides for hose connections. The coil at *L* is of multi-turn design and is used also in connection with continuous or conveyor heating operations.

Induction heating is going to have a broad influence on process planning in the future, much as it has had already in the field of armaments. Linked with this will be the advisability of redesigning certain components, and sometimes complete products, so that induction heating can be applied to its best advantage. As an example consider the lawnmower head shown in Fig. 3. In the past, the blades were formed and hardened, then assembled to the spiders. During hardening some deformation of the blades resulted, and of course, assembly required selected and excessive fitting. Now, by using the induction heating coil, seen at the front, the blades are hardened after assembly. Hardening is limited to a predetermined depth, all that really is necessary, and other-page difficulties are overcome. The hardening operation is performed by progressively feeding the assembly through the series-type coil, from where it is submerged into a quench bath for hardening. About 30–40 seconds is required for the heating and quenching portion of the cycle, for which a speed-controlled feeding fixture is used. In this example, the final assembly is much the same as before, but the process of manufacture has been changed to incorporate the advantage of induction hardening.

Permits Simplified Designs

Examples of modified changes in the design of parts, which sometimes appear advisable, as a result of induction heating, are shown in Fig. 4. The sprocket at *A*, formerly made in one piece, is now made from two separate pieces, as at *B*. Instead of machining the blank from a solid bar, then cutting the teeth, the hub is now made from steel tubing and fitted into the sprocket plate, which is produced by blanking and shaving. Induction heat is applied for brazing the two sections together, as well as for hardening the sprocket teeth. The spool at *C*, cut from a solid bar, is now made of built-up design as shown at *D*, all joints being silver brazed simultaneously. Both these examples are representative of the effect induction heating will have on design technique as a means of lowering manufacturing costs.

Induction heating equipment varies in output power and frequency ranges to suit quite a variety of heating applications. For heavy forging and melting operations, frequencies of 2000 c.p.s. or less are used. For surface heating of fairly large sized parts where a controlled depth of heat is not imperative, medium frequencies from 3000 to 9600 c.p.s. find a broad field. All the units in these ranges are of the motor-

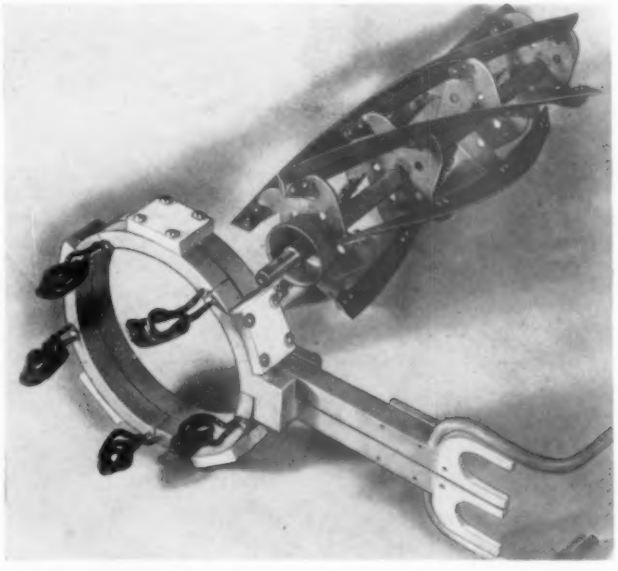


FIG. 3. A lawnmower head assembly on which the blades are hardened simultaneously after being mounted to the spiders.

generator type, and are available with output power ratings from about 10 to 1200 Kw.

The next group comprises generators or oscillators such as the vacuum-tube type, having frequencies in the range of 100,000 to 500,000 c.p.s., and with output power ratings of from 2 to 200 Kw., or more. These units find a broad field for heating parts where the depth of penetration must be more closely held, or where it becomes necessary to heat restricted areas, or where heat to irregular shapes must be specifically controlled. Frequencies above these are sometimes used for heating wire and very small metal parts, but for the average part if too high a frequency is used, heating efficiency may

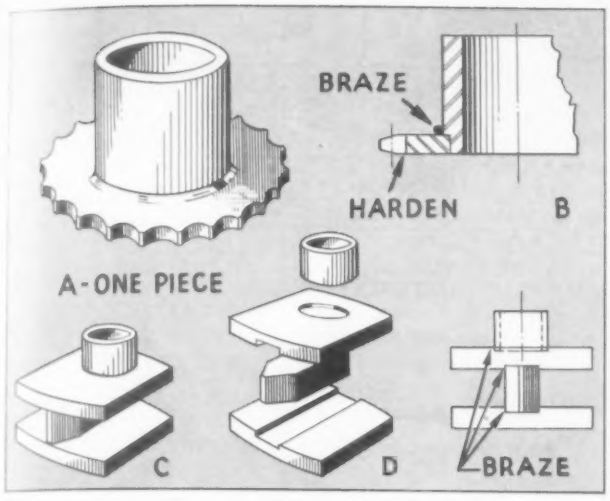


FIG. 4. Two examples of design principles as affected by induction heating, resulting in changes that lower manufacturing costs.

be decreased, or more energy may be needed for a given area or surface.

From a theoretical point of view, there would be a frequency best suited for a given size and shape of part, but as a rule optimum frequency cannot always be considered. Very often frequency is not the controlling factor, so that the average high-frequency generator can be used effectively for a broad range of heating operations. The output power rating in relation to the size and area of work to be processed is usually the deciding factor in determining the best suited equipment.

The most popular types and sizes of induction heating units in use at present are those of the high-frequency range with output ratings of 5 to 40 Kw. They find a broad field in soldering, brazing and hardening of small and medium sized metal parts. Also they lend themselves more favorably to the heating of non-ferrous metals, with low resistivity, such as brass, aluminum and copper, where higher heat producing losses are required to obtain the temperatures needed for soldering and silver brazing.

General Purpose Equipment

A representative high-frequency generator and a general-purpose work table are shown in Fig. 5. The generator has an output rating of 20 Kw., at a frequency of 375 Kilocycles. The work table is arranged for either brazing and joining operations, or the localized hardening of metal parts. It comprises a sink with drain, water inlet for spray quenching, controlled automatically by a solenoid valve, a multi-stage timer for heating operations requiring sequence settings, and quick-change coil connections to facilitate change-over from one job to another, such as is encountered with small lot runs. By placing a Transite coverplate over the sink, the table is made suitable for the handling of brazing and soldering requirements. Practically all the operations described can be handled in a unit of this type.

The induction heating of metals is done by placing the piece to be heated in the electromagnetic field of a current-carrying conductor, usually referred to as the heating coil. The alternating current passing through the coil is induced into the metal piece, without any direct contact whatever. The resistance of that metal to carrying the induced current results in the generation of heat.

The speed at which a metal part is heated depends on several factors, the most important being the relation of the available power to the area being heated; the type of coil and its location in respect to the work's surface; and the resistivity of the metal being heated.

First of all, there must be enough electrical energy flowing through the coil to generate the desired amount of heat into the surface of the work. The number of heat units required, whether expressed in BTU/MIN or Kw., will depend on the size of the part, the nature of the operation and the temperature desired. For soldering and silver brazing, the required heat range is less than it would be for surface hardening requirements, and a ratio as low as ½ Kw. per square inch of surface for steel and 1 Kw. for non-ferrous metals may be more than ample. Also a slow rise may be preferred, in order to allow for proper heat conduction, in which case several pieces can often be handled simultaneously or progressively, resulting in a better loading of the generator.

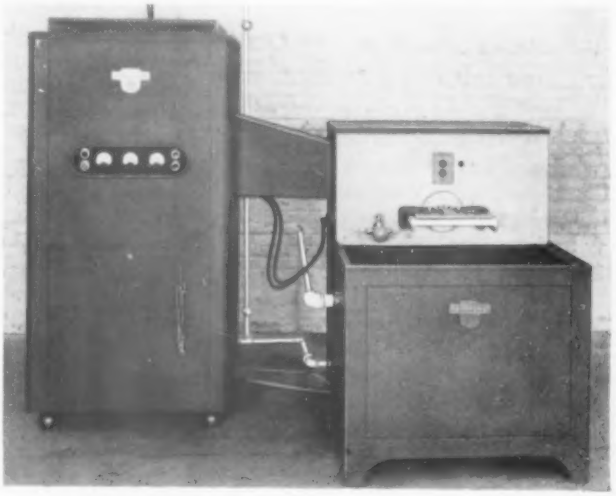
For hardening steel parts, on the other hand, where a fast heat rise is desired, so that heating is restricted almost entirely to the work surface, a ratio of from 2 to 5 Kw. per square inch of surface is usually needed. In some instances, where a restricted case hardness is desired, this ratio may be exceeded. Likewise, many parts can be satisfactorily heated for hardening at a ratio of 1 Kw. per square inch. At this ratio, however, a greater amount of thermal heat conduction below the surface may result, and the overall heating time will be increased somewhat proportionately.

Coupling Affects Power Needs

Any figures on power requirements can only be broad in scope because other factors bear a direct relation, especially the spacing between the coil and the surface of the work being heated, usually referred to as coupling. In practically all induction heating applications, coupling is the one of the most important considerations, particularly where maximum heat transfer is desired. The flux density surrounding a coil is greatest on the inside surfaces and diminishes in proportion to the square of the distance between the coil and the work. This means that a small increase in coupling results in a considerable reduction in heat transfer to the part being treated.

If a perfect coupling were possible a 100 percent transfer of current could be made between the coil and the work. Clearances are required, however, so that the transfer of energy usually is on the order of 50 to 80 per cent of the output rating. This loss must be considered when calculations are being made for induction heating estimates. For local hardening operations, coil couplings are made to about 1/16 to ⅛ in. for the average applications, and somewhat more for silver brazing or soldering where slower heating is desirable, and often the maximum heat transfer is not a necessary requirement.

FIG. 5. A high frequency induction heating generator and a general-purpose work table suited to miscellaneous hardening and brazing.



As has been mentioned, linked with power and coupling, in determining the rate of heating, is the nature of the metal being heated, particularly in regards to its resistivity, or the rate at which electrical energy is transformed into heat. Metals with a high resistivity are easier to heat than those with low resistivity. As shown in the accompanying table, a piece of steel which has a higher resistance than brass, for example, can be inductively heated at a much faster rate, up to its critical point, about 1350° F., where it becomes nonmagnetic, resulting in a slower rate of heating.

The high-frequency current passing through a heating coil must, of course, make a complete circuit. Its path follows the shape of the coil, which can be cylindrical, flat or any one of a variety of shapes. It is important, however, that the current always be made to flow in one direction, regardless of shape of coil, and not back and forth such as to cause a cancellation of the magnetic flux. From the heating coil, an induced counter-magnetic field is set up in the work in the form of closed eddy-current loops which produce the heat.

The frequency of the current produced by induction heating units bears a direct relation to the depth of penetration to which the induced current will flow on the surface of the work,

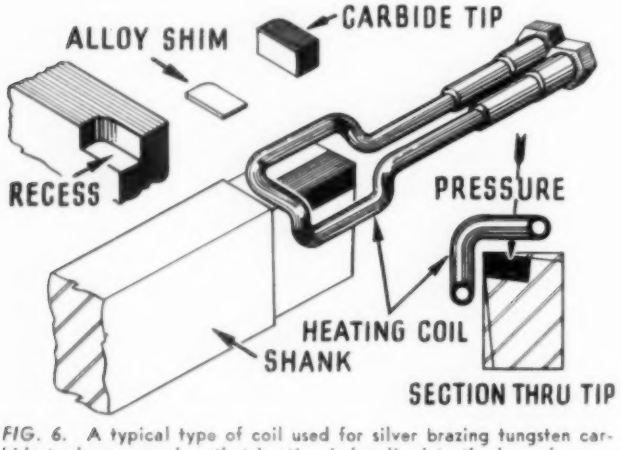


FIG. 6. A typical type of coil used for silver brazing tungsten carbide tools, arranged so that heating is localized to the brazed areas.

since the depth of heat varies inversely with the square root of the frequency. The lower the frequency, the deeper will be the heat penetration. The rate of heating is not necessarily affected by variation in frequency, providing the same power and equal masses are being heated. At the higher frequency, however, a shallower depth may reach a given temperature faster than if a lower frequency were used. On the other hand, to obtain heat penetration by the higher frequency current to equal the depth of a lower frequency, would be more a function of time, or the rate at which heat would be conducted from the surface to the depth desired.

Localized Heating Avoids Stresses

In the brazing of tungsten carbide tools, the application of heat to the joining surfaces is of utmost importance due to the wide difference in co-efficient of expansion between the tip and the shank. Very often when excessive heat is applied, such as by torch, a pronounced shearing stress is set up when the brazing alloy "freezes," and then as further cooling takes place, there is likelihood of a braze crack developing in the tip just about the joint. This is due to the fact that tungsten carbide has the least expansion of any metal, when heated, whereas the usual steel shank expands to proportions of four to five times, or even more, that of tungsten carbide under like heating conditions. Likewise the higher the melting temperature of the alloy, the more pronounced will be the variation in expansion. To overcome this condition as far as possible, therefore, the heat should be limited or confined to

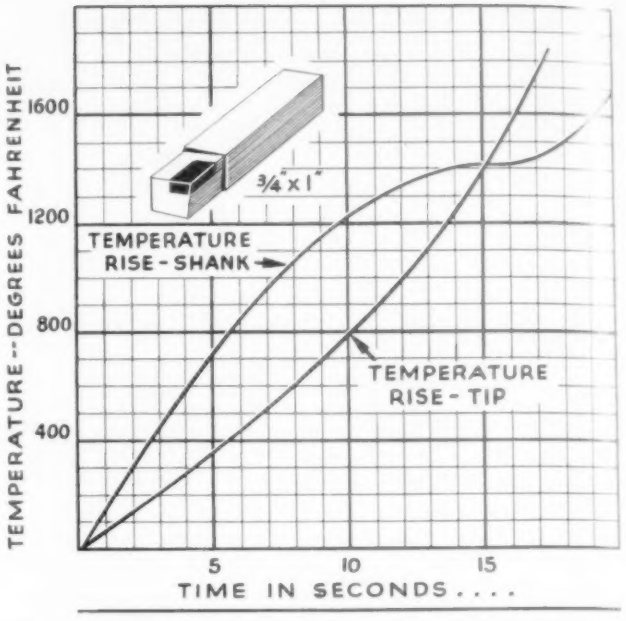


FIG. 7. Chart showing the comparative temperature rise of a carbide tip and steel shank when placed in the magnetic field of a heating coil.

the boundary of the recess in the tool shank, and an alloy with as low a melting temperature as is consistent with a firm, solid bond should be used.

In this direction, the use of silver alloys which become fluid in the 1250 to 1450 deg. F. range, and high-frequency current as a means of heating have resulted in a marked improvement over former brazing methods. A representative example is shown in Fig. 6, illustrating a usual single-point tool. Induction brazing includes the normal recessing of the shank, into which is placed a shim of silver alloy, and finally the carbide tip. Sufficient flux must of course be ap-

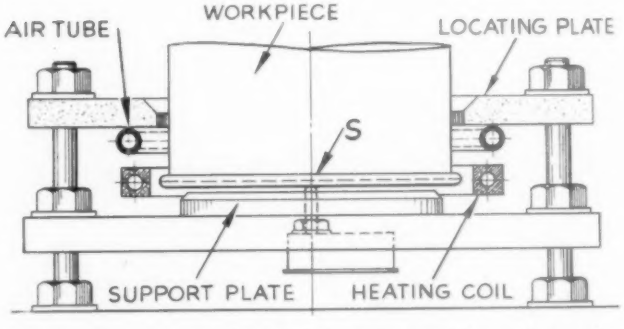


FIG. 8. Constructional details of the fixture used for soldering the can in Fig. 9, showing the locating plate and air tube for cooling.

plied to all surfaces. The most effective heating coil, capable of limiting heat to the recessed area, is the single-turn design shown, which closely follows the edge of the recess. When current is applied to the coil, the tip and the recessed surfaces of the shank will heat somewhat independently of each other. The shank will heat rapidly up to the critical point, about 1275 to 1325 deg. F., where magnetism ceases, and the rate of heating falls off. The carbide tip, on the other hand, being non-magnetic, has a slower initial heating rate which accelerates as the temperature rises, due to the increase in electrical resistivity that takes place. These heating rates are shown in the chart in Fig. 7, illustrating that the high frequency method of heating permits bringing the tip and the shank to brazing temperature without wide variations in heat. The brazing time is representative of a ¾ x 1 in. tool, which

ires about 15 sec. to complete, using a 20 Kw. high-frecy generator.

The shaded part of the shank, shown at the lower right of ite six, is representative of the usual area heated by a of the single-turn type. Expansion of the shank is reted as a result of the unheated mass, so that the stresses the steel and the tip become more equal, and overcome ing strains. A coil of this type also facilitates pressing of carbide tip firmly in place, without the necessity of movthe tool away from the coil. The thickness of alloy shim, ually used for such tools, is .002 to .004 in. The fluidity of er alloy when melted is such that it will follow the entire cessed area, so that a single flat shim will handle the averge brazing need.

A simplified form of fixture for soldering a coverplate to an oval can is illustrated in Fig. 8. The work assembly is placed into the fixture, obtaining its alignment from the locating plate at the top, which assumes concentricity with the heating coil, positioned underneath. The work rests on a support plate, which in turn is attached to the transite base. As a means of automatically engaging the cycle of the generator, a spring pin *S*, operated in series with a limit switch is

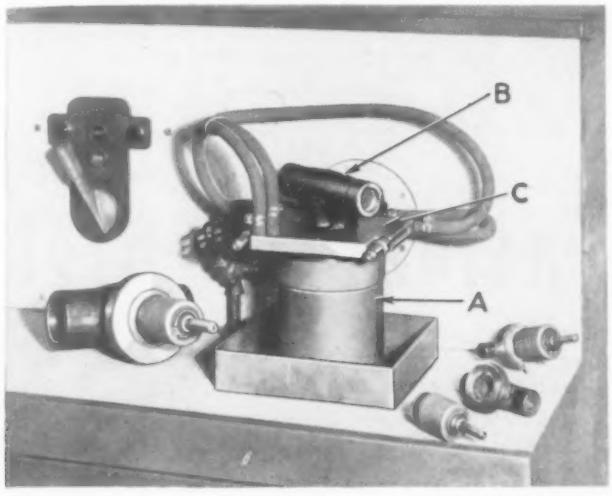


FIG. 9. A fixture used for brazing a valve body-bellows assembly, including a water tank for controlling heat dissipation.

used. When the weight of the can assembly depresses the pin, the limit switch is actuated and automatically starts the heating cycle. Since the can is loaded at the time of soldering, it is desirous to limit the heat as closely as possible to the joint, therefore, immediately after the completion of the soldering, approximately five seconds, a solenoid valve is automatically opened to provide a blast of air through the tube, attached to the underneath surface of the locating plate. This air prevents conduction of heat into the upper portion of the can and also cools the soldered joint quickly so that the completed part can be removed from the fixture without delay.

Avoids Heating Nearby Parts

A setup for brazing a bellows assembly to a valve body is shown in Fig. 9. In this operation it is important that heat be confined to the joint only, and not be conducted through the bellows, therefore the fixture includes a water chamber into which the bellows is submerged, with the exception of the portion at the joint. A small quantity of water flows into the chamber *A*, and spills over into the drain surrounding it. The valve assembly *B* is supported and aligned by a locating ring positioned within the water chamber, so that it is centrally spaced within the solid-type coil *C*. The heating coil is provided with quick-change leads, enabling other sizes of coils to be applied as may be needed for the different types of valve bodies shown. The brazing table has two working

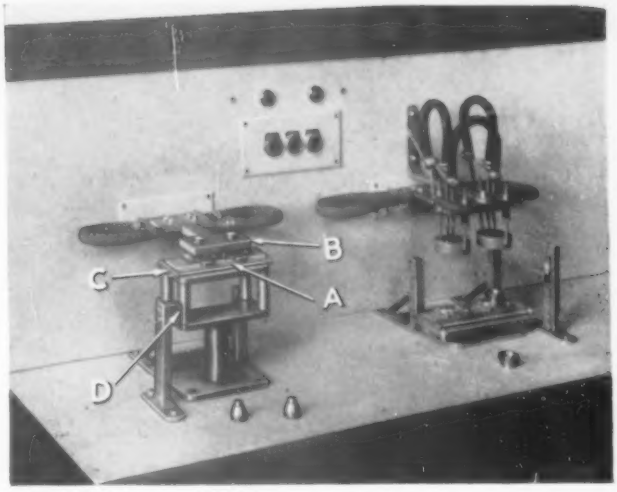


FIG. 10. A heating fixture arranged with vertical travel to elevate work to the coil, and provided with automatic ejection for quenching.

positions, permitting the loading of one while the other is in use, thus providing for maximum output frm the high-frequency generator.

A rise-and-fall type of fixture for hardening valve bushings and cocks is illusrated in Fig. 10. The operation is automatically timed and controlled and only requires the loading of the work and engagement of push buttons. With two pieces located on the fixture nest plate *A*, the left push button on the panel is engaged, causing the fixture to rise automatically, placing the work into the series type external heating coil *B*. At the completion of the heating cycle, the fixture is lowered, during which movement the pin *C*, engages

FIG. 11. Hardening the teeth of a large segment is handled individually in this setup, which includes automatic heating and quenching.

the pawl *D*. Since the fixture nest plate is hinged, this contact causes it to tilt upward at the front to a sufficient angle, so that the heated parts can slide off at the rear, and drop through an opening in the top of the table, into an oil quench tank located underneath. As the fixture reaches the bottom of the stroke the pin leaves the pawl so that the hinged plate returns to a level position, where additional parts are loaded. The fixture at the right operates on the same principle, although the coil is of the series internal heating type, provided with guide rings to assure alignment of the work in relation to the coil.

A single-purpose induction heating work table arranged for hardening the teeth of a large segment is illustrated in Fig. 11. This unit comprises an indexing fixture, heating coil

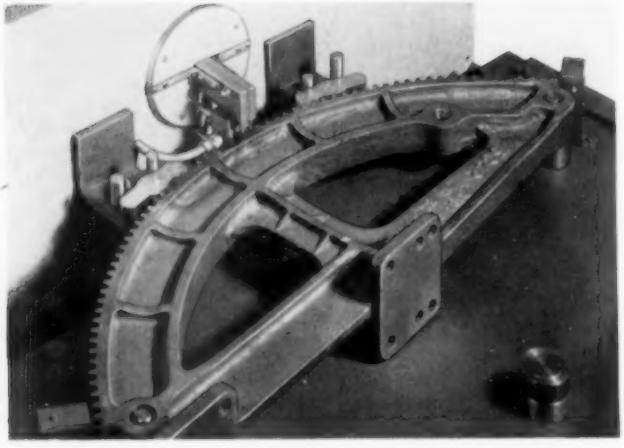


FIG. 12. A close-up view of fixture, coil and table for hardening teeth of segment in Fig. 11, showing pawls and dentents for index alignment.

and quench facilities, as well as automatic timing control. The segment is made of cast steel, and is a type of part that might normally offer some difficulties in heat-treatment, especially if the entire casting had to be heated, but by means of induction heating, set up so that each tooth is hardened separately, deformation is practically eliminated and uniform hardness is easily provided.

A close-up view of the operation is shown in Fig. 12. The fixture is mounted on a slide which has transverse movement, enabling the segment to be withdrawn, indexed and advanced again for each heating cycle. Pawls and detents are provided so that proper indexing is assured, and the possibility of a tooth striking the heating coil is prevented. The cycle automatically engages with advance of the slide. This cycle includes an 8 sec. duration of heat, and a 3 sec. quench. When this cycle is completed, the pilot light is turned off, which is the signal for the operator to index to the next tooth.

Future Possibilities Almost Unlimited

The field of high-frequency induction, as has been outlined, will undoubtedly have a marked effect on future process planning, as it already has influenced the processing of so many of our armaments. Manufacturing costs in the post-war period will have a direct relation to distribution. The lower the selling price of a commodity, the broader will be its acceptance, and likewise its public benefit. In this respect there is an important role ahead for this process of metal heating, and much of the responsibility of application will fall within the duties of the tool engineer.

Standard Classification for High Speed Cutting Tools

By Anders Jansson

AS A definite step toward allaying much of the confusion in classifying tool steels, three large consumers—G.M.C., Ford and Chrysler—have jointly standardized on classification symbols for High Speed Steel tools. That is, the material is to be classified according to its major alloying element, its chemical composition in percentage, and the manufacturer.

Thus, all high speed steels in which Tungsten predominates will be designated by the letter T, while a predominant Molybdenum alloy will be designated by M. A figure then denotes percentages, and a concluding letter the maker. For example, a tool made of 18-4-1 analysis, supplied by Blank Steel Company, would be marked T-1-Z, assuming Z to be the symbol letter of the maker.

Complete Information in One Symbol

In addition to these symbols, there will naturally be the trade mark of the tool maker. For instance, the consumer may order a stock of formed cutters from the Nemo Tool Company, which will imprint its own name or trade mark in addition to the classification symbols. The consumer then has complete information regarding the tool from steel manufacturer to tool maker.

The classification should reduce inventories, especially of tools of similar analysis. Heretofore, the consumer has had no means of identifying the material except by makers' symbols. He may have had, in his stockroom, a number of different brands of steel, some or all of which may have been identical as far as analysis is concerned. To aggravate matters, various departments may have asked for as many different brands, regardless that analysis may have been the same.

And, while this demand may have pertained to tool bits, rather than to formed or manufactured cutters, inventories would nevertheless run high. The only method of determining analysis, at the disposal of the average consumer, was by spark test—a rather dubious procedure that depended largely on the experience and discretion of the tester. The whole has been wasteful and costly, especially in view of wartime demands and the incidental shortages of critical alloying elements.

Several years ago, however, the Gorham Tool Company, Detroit, of which L. Clayton Gorham is president, had established standards of classification—as described above and detailed in the accompanying chart—for its own use. As a result, the company not only had complete control of its inventories, but had standards of comparison as well.

Then, in '37, a customer asked for a copy of the Gorham system of classification. This was successfully applied to his own inventory, of high speed steels, which consisted largely of tool bits. As a result of this request, Mr. Gorham was inspired to publish a booklet—now in its 4th edition—in which

set forth the essential principles of classification standards. The booklet, in turn, suggested a general adoption of the system by the trade, and, to stimulate interest, the matter of standardization was referred to the American Society of Tool Engineers for presentation to the American Standards Association. It is now under consideration although, in view of the many factors involved, definite action was necessarily deferred.

Recently, however, a committee comprising representatives of General Motors Corporation, Chrysler Corporation and Ford Motor Company, convened and agreed on the adoption of the system—now known as Standard Identification for High Speed Cutting Tools. The classification standard sheet, as adopted by "All Three," is modelled after the Gorham original and is so nearly identical that it is shown in its essential form below.

A number of other large consumers have since decided to adopt the system, while a majority of steel manufacturers have agreed to adopt it in the marking of their products. It is assumed that its general acceptance by the trade is only a matter of time.

Identification Symbols For High Speed Tools

Cutting tools made or purchased by Blank Mfg. Co. must be marked according to the following symbols.

All high speed steels in which Tungsten is the major alloying element will be designated by the letter "T." All high speed steels in which Molybdenum is the major alloying element, even though Tungsten is present, will be designated by the letter "M."

TUNGSTEN HIGH SPEED STEELS—"T"

Chemical Composition in Percentage				Analysis Symbol
Tungsten	Chromium	Vanadium	Cobalt	
18.00	4.00	1.00		T-1
18.00	4.00	2.00		T-2
18.00	4.00	3.25		T-3
18.00	4.00	1.00	4.00	T-4
18.00	4.00	2.00	8.00	T-5
22.00	5.00	1.50	12.00	T-6
14.00	4.00	2.00		T-7
14.00	4.00	2.00	5.00	T-8

MOLYBDENUM HIGH SPEED STEELS—"M"

Chemical Composition in Percentage						Analysis Symbol
Molybdenum	Chromium	Vanadium	Tungsten	Cobalt	Boron	
8.00	4.00	1.00	1.50			M-1
5.00	4.00	1.50	6.00			M-2
8.00	4.00	2.00				M-10
8.00	4.00	1.00		2.50	Added	M-20
8.00	4.00	1.00	1.50	4.00		M-30
8.00	4.00	1.50		8.00	Added	M-40

The following letter symbols have been assigned to denote the various manufacturers of domestically produced, commonly encountered, brands of High Speed Steel.

Symbol	Manufacturer	Symbol	Manufacturer
A	Vanadium Alloys Steel Company	N	Simonds Saw & Steel Company
B	Firth Sterling Steel Company	O	
C	Henry Disston & Sons Company	P	Vulcan Crucible Steel Company
D	Universal Cyclops Steel Company	Q	
E	Bethlehem Steel Company	R	
F	Latrobe Electric Steel Company	S	
G	Allegheny Ludlum Steel Company	T	
H	Columbia Tool Steel Company	U	
I	Braeburn Alloy Steel Company	V	
J	Halcomb Steel Company	W	Jessup Steel Company
K	Carpenter Steel Company	X	Crucible Steel Company
L	Midvale Steel Company	Y	
M		Z	

EXAMPLES

If a tool is made from an 18-4-1 analysis steel, supplied by the Vanadium Alloys Steel Company, the tool will be marked: T-1-A.

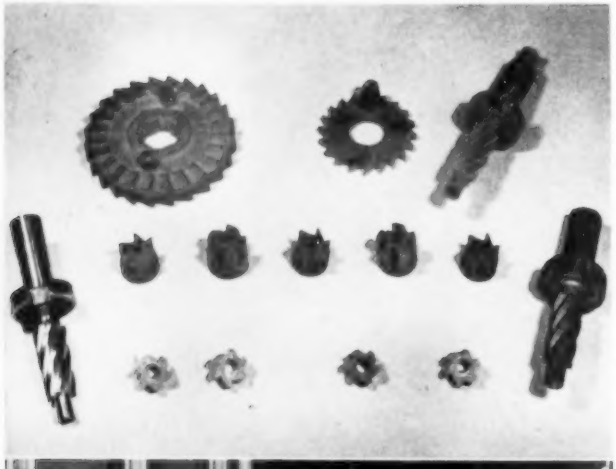
A tool made from an analysis of the 6-6 type steel, supplied by the Universal Cyclops Steel Company, will be marked: M-2-D.

CAUTION

Markings on tools are for identification only and should not be confused in any way, whatsoever, with specifications. The symbols are to be used to designate material only, and the same procedure employed in the past for procuring raw material and manufacturing tools should be followed.

NOTE: The above specifications are given without considering whether patents may or may not be involved. In all cases, therefore, the supplier should be required to assume patent liability.

How Ford Rehabilitates World



Veterans employed on new machine for pattern-making designed by R. R. Rausch, Rouge Plant General Superintendent.

by D. B. Pratt

USING a streamlined technique, developed by Ford technicians, veterans at Camp Legion—Henry Ford's rehabilitation camp for handicapped veterans of World War II—are learning a brand new technique that bids fair to revolutionize the production of intricate high speed steel castings.

The Camp Legion plant is not a regular production plant. Its prime purpose is to enable handicapped veterans to learn a useful trade that will enable them to earn a respectable living by doing a useful job. Many are learning how to make precision castings. In addition, if they so desire, they learn woodworking, farming, auto mechanics, tool designing, plastics, forestry, mechanical drafting and a wide variety of other subjects.

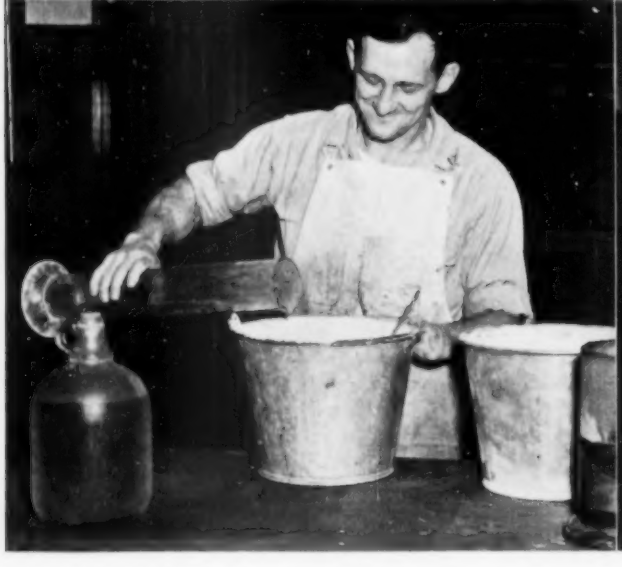
Any Medical Discharge Eligible

Any disabled veteran with a medical discharge from one of the armed services or the Merchant Marine is eligible for admission. While at Camp Legion he receives free board and room and receives three dollars a day while he learns by doing.

There are no strings attached. He can stay as long as he likes, work as much or as little as he pleases, and is not obligated to work for Ford at the conclusion of his training.

Precision casting has proved to be a popular subject for study by many of the veterans. While they learn they produce side mill cutters, key way cutters, end mills, spot facers, circular form tools which are used in the Camp Legion machine shop.

UPPER LEFT Typical precision castings of Tools made at Camp Legion. *LEFT CENTER* Pouring castings from a Ford designed electrode furnace at the Camp Legion training school. *LOWER LEFT* A veteran of World War II mixes the investment material used in the precision casting process perfected by Ford technicians. *BELOW* Group mounting of wax patterns for precision castings on a wax base preparatory to surrounding with investment material.



War II Veterans

At the outset the primary objective of Ford's precision casting experiments was the salvaging of considerable quantities of high speed tool steel then being scrapped. Now, however, it is felt that the vast possibilities inherent in the process offer unlimited opportunities for effecting substantial reduction in costs by enabling foundrymen to cast precision parts of very great hardness. Thus the need for costly machining of super-hard materials, such as supercharger buckets, is eliminated.

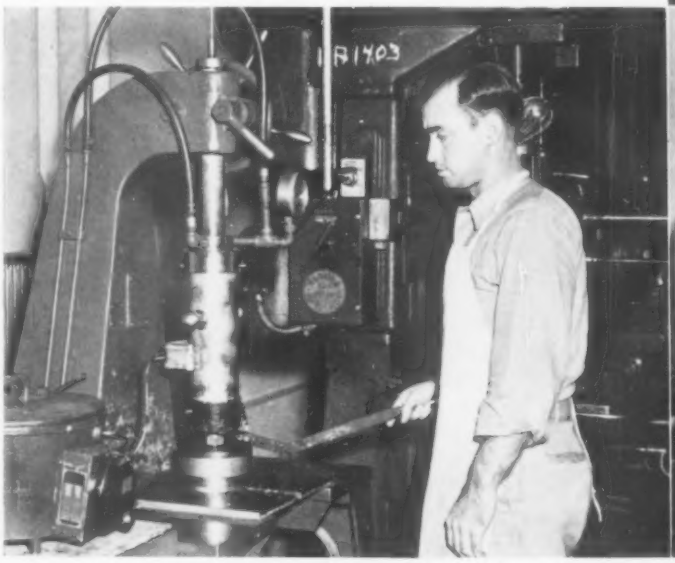
Plastic Inserts Improve Patterns

In the Ford process one or more plastic inserts are made from a single master tool. Plastic molds were developed for two reasons: to enable disabled veterans to handle them with greater ease, and to reduce costs. They have been markedly successful in both respects, without lowering the quality of the patterns.

Patterns are made by injecting hot wax into the molds. A machine for this purpose was designed by R. R. Rausch, general superintendent of the Rouge plant. After cooling, the patterns are removed and mounted in a group. The number depends on the size of the tools. They are then surrounded by the investment material. At present various kinds of investment materials are used. They include 80 mesh banding sand, 25% silica flour and 140 mesh silica flour. A commercial binder is used.

After the investment is thoroughly vibrated the mold is placed in a Hayes electric furnace. The wax used is burned away and the mold heated to a temperature of 1,600 degrees Fahrenheit.

The final step in the casting process is the actual pouring. At the Camp Legion shop special Ford designed electric melting pots are used.



UPPER RIGHT Pouring investment material into the mold containing the wax patterns. *RIGHT CENTER* A conventional metal mold containing six wax patterns, a Ford designed light weight plastic mold with removable and interchangeable inserts. *LOWER RIGHT* A precision investment mold being removed from a Hayes electric furnace. *BELOW* Veteran operating a special wax injection machine, designed by Ray R. Rausch, Supt. Ford Rouge plant.

Tooling Instrument

1. The Panoramic Sight. It's Construction and Use – by Francis M. Shull

THE PANORAMIC SIGHT M-12 is a telescopic gun sight used to aim a gun, usually a field artillery weapons, at its target. You are all familiar with sights on an ordinary rifle. Aiming a rifle consists only of lining up the two points on the barrel so that both appear directly between the eye and the target. If the target is small and distant, this is not always easy. The sights are close to the eyes and, consequently, either sights or the target will be blurred in the vision. To remedy this, riflemen, especially for long range sniping, use a telescopic sight.

There are two advantages. First, the target can be magnified and the more easily identified. But of as great importance, instead of the two fuzzy points on the barrel, there is just one point, the intersection of cross lines, to be lined up with the target. This appears sharp and distinct and can be placed directly over the target as if a surveyor's rod man were actually there.

A simple straight telescope is sufficient for sighting a rifle or other small weapon. It might be sufficient for artillery if the gunner could always see his target, but the long range and necessity for concealment makes this infrequently the case. A suitable aiming point is chosen whose relationship to the gun position and target is known. Instead of having the telescope parallel to the gun barrel, it is turned at a predetermined angle. This angle is found usually by surveying methods using another instrument such as the aiming circle. The aiming circle is just a military version of a surveyor's transit. When the cross line of the gunsight is brought onto the aiming point by moving the gun and telescope together, the gun will be aimed at the target. It is because the gunner must be in a fixed position, protected from small arms fire and able to operate elevation and traverse hand wheels of the gun while the aiming point may be anywhere—even in back of him—that the Panoramic Telescope (Fig. 1) has been developed.

Francis M. Shull, Engineer at the Eastman Kodak Camera Works, graduated from Cornell in 1934 and was a physics major in Arts College. After a year in testing and optical work at the U. S. Bureau of Standards he joined Eastman eight years ago. He is a member of Rochester Section, Optical Society of America, and Cornell Club of Rochester.

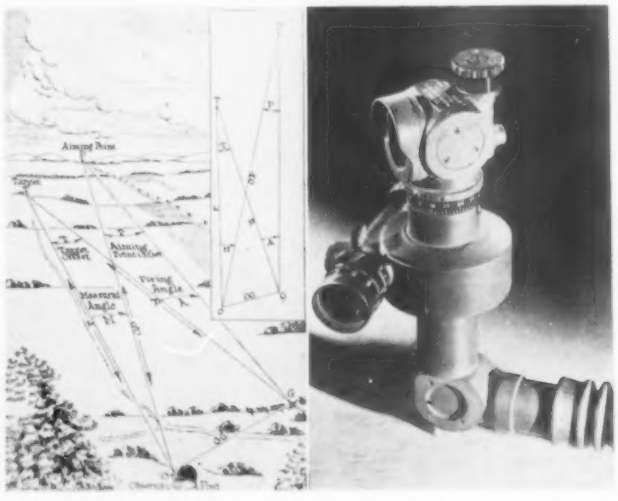
Regarding the optical system of the instrument, light enters through a window which is just a cover glass to keep out dirt. The head prism directs it downward just as would a plane mirror set at 45°. This can be rotated about a horizontal axis to depress or elevate the line of sight. It may also be rotated about a vertical axis to measure off horizontal or azimuth angles in any direction. As would any mirror, the head prism inverts the image. A dove prism is used to erect it again. But besides being inverted when the head prism is as shown, the image would be rotated about its center as the head prism is rotated in azimuth movement in a horizontal plane were it not compensated by a synchronized rotation of the dove prism. The dove prism, again essentially a single mirror, has the property of rotating the image at twice the prism's rate of rotation. Below the dove prism is the objective lens which forms a real image of the scene on the reticle. This image is kept erect by reflecting it twice in the roof prism. Like the head prism, the roof prism bends the axis of the system through 90°. But there are two reflecting surfaces at right angles to each other which intersect in a sharp ridge along the center, hence the name roof prism. The reticle and the real image then are observed superimposed through the eyepiece. The eyepiece is really no more than an eye loop to magnify the reticle and scene images. The whole telescope has a magnification of four times and a field view about 160 mils or a little more than 9° wide.

There is one other optical feature of interest. The reticle itself consists of lines etched in the glass surface. These grooves are then filled with a white diffusing medium so that when a light is shined through the small window at the edge, they will appear as light lines on a darker background for use at night.

So much for the general optical system.

In order to measure the angles required, the rotational movement of the prisms are obtained by precision worms and worm gears. The worm shafts have knobs graduated in mils. In the case of the azimuth knob, there are 100 divisions and each hundred mils is marked off around the neck of the

FIG. 1. The Panoramic Telescope—"Periscope" for the artillery man.



Work for Factory Production...

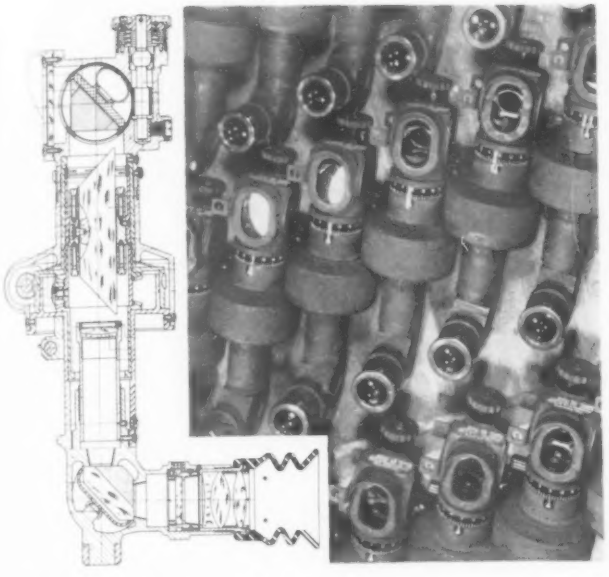


FIG. 2. Sectional view of instrument.

instrument. All accuracy requirements are expressed in mils, so this unit deserves a brief explanation.

A mil is a unit of angular measure like degrees, minutes, seconds. There are 64,000 units in a full circle. This makes it, roughly, equal to three minutes of arc. The reason for this unit is that it is a good approximation to the angle subtended by one part at a distance of 1000 parts. Hence, the name mil. Simple triangles are solved quickly in the head. For example, if the length of an enemy vehicle is known to be 6 yards and the length observed is 2 mils, then it is three thousands of yards away. Similarly, the required angles for indirect aiming can be quickly computed when range and distance to observer are known. In terms of dimensions of parts, a mil is .001″ per 1 inch length, .002″ per 2″ length, etc.

Construction Requirements of Sight

In preparation for papers to follow, I shall outline the general construction and main requirements of performance of this sight. The whole instrument is shown in section in Fig. 2. First of all, it is located on the gun by the projection at the bottom and by the skirt under the mid-section. These two diameters determine the vertical axis about which the optical system must rotate. The lug is held against a stop on the gun mount to determine the zero azimuth position. The main part of the telescope proper, the elbow and shank, carrying the optics from eyepiece to objective lens, is held fixed with respect to the gun. The top of the shank is a tapered bearing on which the azimuth worm gear rotates. The housing, screwed onto the shank carries the worm and holds the tapered bearing together by means of the spring washer. Inside the worm gear, the dove prism is mounted in a sleeve carrying a beveled pinion. This runs between two beveled gears, one pressed into the worm gear, the other adjustably locked into the shank. The head assembly is screwed into the top of the worm gear and turns with it while the dove prism rotates at half the rate of the gear. The head prism is mounted in a barrel having gear teeth cut in it which mesh with the small elevation worm.

The errors which must be controlled are manifold. As a foundation, the two locating diameters, which are on two separate parts, shank and elbow, must determine an axis parallel to the axis of the taper bearing within a fraction of a mil. The requirement is that as the head is rotated in azimuth, the line of sight shall not change in a vertical direction by plus or minus one mil. This is usually referred to as the horizontal plane error. The error can arise from misalignment of the shank and elbow or as a result of improper adjustment of the dove prism, or any slight misfit of parts which will cause the dove prism to be tilted.

Optical Accuracy Essential

The angles measured in azimuth must be accurate to within one and a half mils including any backlash between worm and gear. At first thought, this may not sound like precision as compared with, say, a surveyor's transit, but there is a big difference between these two instruments. The transit measures an angle by means of a divided circle of considerably larger diameter than the gear of the Panoramic sight we are talking about, and it has only one bearing to be controlled. Nor is it expected to stand the shock of gun fire. Let us look at what the requirement means in terms of the accuracy of parts on the sight. The gear is less than 1.5″ in radius. An eccentricity of one thousandth inch with the rotational axis can produce an error of .6 mil, and this is only one source for error. There will be small cyclical errors in teeth and in the worm, and the parts must work freely to keep backlash to a minimum. Add to this, some errors in the optical parts themselves, and the requirement begins to look tougher. It is necessary to be able to use a dove prism which will introduce .3 mil error in both azimuth and elevation.

The head prism is mounted in a relatively large diameter barrel having a very thin wall. This barrel must be round and fit its bearing very closely, yet it must be free to turn smoothly. To make this the more difficult to achieve, the prism is held in the barrel with a spring which can easily warp the barrel out of shape. The maximum backlash permitted between knob and line of sight is one mil. Since the corresponding rotation of the prism is only half a mil, this represents about four ten thousandths inch at the circumference. This must be due to the sum of clearance between barrel and casting, between barrel and worm and in the worm shaft bearings. Besides the backlash requirement, two other errors must be controlled here. Side play, a horizontal shift in the line of sight similar to backlash, is held to two tenths mil, and the line of sight must follow a plumb line within one mil over the full range of movement of the head prism. Backlash in the bevel gear train does not affect the precision of the instrument, fortunately. It will cause the whole field of view to tilt, however, and because this may lead some gunners to distrust the instrument, it must be closely controlled. More important here is smoothness of action. The bearing which really determines the position of the dove prism is the lower end of its mount. Any tendency to drag on this bearing will cause

tne prism to tilt slightly, and only a few ten thousandths of an inch will reject the sight.

Besides the problem of maintaining the accuracy of parts and assembly, as in all optical instruments, it is necessary to keep the parts clean. Even minute amounts of dirt, hardly discernible at the time of assembly, can form the matrix of moisture condensation at some later time. Under tropical conditions, this can support the growth of fungus that will make the sight unusable, so it is necessary to clean not only the optical parts, but also their mounts and to remove any loose material from the enclosure which might fall onto optical surfaces. Then the whole instrument is sealed up water tight.

Having described some of the requirements of this job, I shall leave it to the authors to follow to tell you how these requirements were met.

2. Machining, Assembly and Testing Methods Used in Optical Instrument Manufacture—by Paul G. Yingling

IN PLANNING the manufacture of Fire Control Instruments on a production basis, we had to consider a number of problems. A few of these will be all we have time for in this discussion.

First—The time element that was allowed to make deliveries was short.

Second—The need to use existing equipment whenever possible, to procure additional equipment where necessary, and to use standard machine tools.

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Third—Breaking down operations and tooling to get the simplest procedure, so that any operator could be trained to perform the operation correctly.

The first step was to determine the function of each part and then plan how it was to be processed. The methods employed by the Instrument Shop, in many cases, could not be used as they were too slow and, in other cases, not adaptable due to large quantities required. The common practice in Instrument Shops is to make up parts to a certain point, fit to mating parts, mark in sets, finish plate or paint individual parts as required and then refit and make final assembly.

To eliminate this method, it was necessary to manufacture the parts to very close tolerances, allow for finish if it was to be applied, allow for final fitting, if any, in assembly. This necessitated a number of drawing changes and the government agencies involved were very co-operative so the results obtained have proven satisfactory.

No special machinery was used as the time required to procure it was not available. Standard machines were used and, in some cases, slight changes were made and tools were adapted to the machines so the desired results were obtained.

The cutting and checking of the Zerol gear, azimuth worm gear, and bevel pinion, presented a problem that was overcome by very careful planning. Accurate index mechanisms were a positive requisite. These we procured. Tooling was

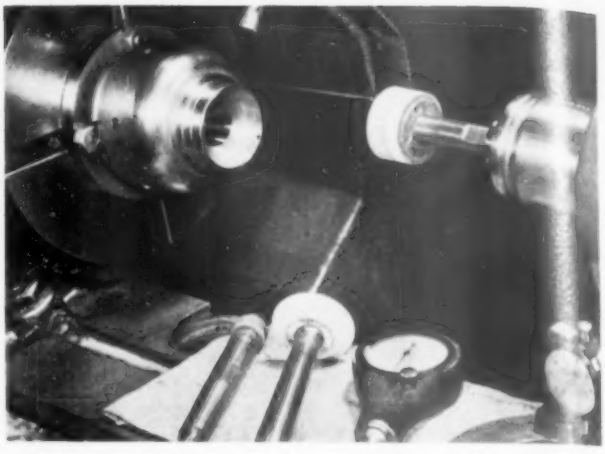

FIG. 3. **10 inch universal grinder converted for quick change from straight to tapered holes, and for face grinding.**

very accurate and run-out of spindles, arbors and testing equipment was held to .0001". Fine feeds were necessary to secure the finish required.

The accuracy of the instrument depends largely on the tooth-to-tooth spacing and backlash. This does not differ from an Instrument Shop procedure—only in that the tooling had to be able to stand hard, continued use for the quantities required.

The azimuth worm gears made in small quantities without proper tooling would present many difficulties. This was planned so that eccentricity was held to a minimum. Using turret lathes, and one automatic screw machine, a blank that was very accurate was made. As the concentricity is held to .0005", it was necessary that as many surfaces be ground at the same set up as possible. A 10" universal grinder (Fig. 3) was converted so the head stock could be rapidly moved to grind straight holes and the tapered holes. The faces were also ground at the same setting. Parts were rough ground first, by the same method. In finish grinding, a swinging fixture was incorporated on the machine which pressed in the one zerol gear, so the center hole in the gear and the worm gear could be ground straight—thus forming the bearing for the dove prism holder. Thus, all interior surfaces and faces were true. To grind the outside dimensions, a series of arbors were made that varied .0001" in dia. The tolerance of the hole is .0003" and the arbor that fit best was used. This gave the required concentricity.

The taper section of this gear must fit a mating part without any looseness—so it was ground to a .0005" tolerance. This had another purpose in that it served as a gauge for the

FIG. 4. **Turret tooling on standard optical lathe insures production with extreme accuracy.**

g part. To insure a perfect fit for lapping in assembly, mating part was ground on the taper, insuring against ing or looseness. A feeler gauge was used between the mating faces to indicate the amount of stock allowed for ing. This is critical as there is a 7 to 1 ratio between the and face. These parts are then numbered and kept in for the balance of the machining operations.

The mating part referred to is also machined up to and ding the painting or finishing operation before grinding, ing it simple to keep in sets. The grinding of all sur- s is done on a 10" universal grinder as outlined for the m gear which insures concentricity. The cutting of the m gear teeth follows the finish grinding of this sub-as- bly.

The machining of the Housing, Elbow and Rotating Head, sented no major problems as operations could be broken down and tooled to get accurate machining. However, there were many threading operations that required concentricity with bores and diameters. Again we were able to use a stand- ard optical lathe (Fig. 4) to quickly perform these operations.

These optical lathes are not generally known, as they were primarily developed for making optical mounts. They have a lever cross-slide, and eight position turret and provisions for fast thread chasing. Turret positions are indivdually adjust- able and machines are primarily intended for light work to ex- tremely close tolerances. Ample gauges were a necessity, as parts must be interchangeable.

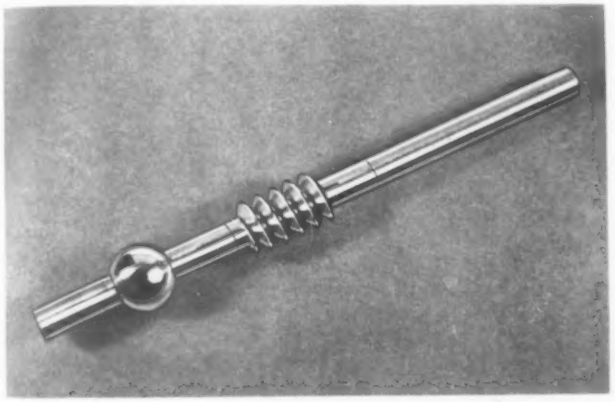

FIG. 5. **The precision thread on this stainless steel worm is ground from the solid.**

It may be of interest to note that on the Elbow, the prism seat was machined first and all subsequent operations were machined from there.

The Rotating Head, which has thin sections subject to changing sizes when lacquer is baked on, had to be finished machined in the bore that fits the right angle prism holder after lacquer is applied. As this is a gauge fit, it is lapped in assembly, so one thousandth of an inch is left for lapping. The dove prism holder also carries the stud for the bevel pinion. Instead of making this piece from the solid, the stud is brazed on and finished from the O.D. which is held to .0003". A new method of clamping the dove prism was de- veloped as the previous design would not hold collimation in assembly.

In machining the various lens mounts and holders, no trouble was experienced, as blanks were made on automatic screw machines and finished on bench or optical lathes. A majority of the threads were chased on the optical lathes which is more accurate and much faster than other known methods. All threads are Class III. Again ample gauging facili- ties were necessary to insure interchangeability.

Two stainless steel worms used (Fig. 5), again illus- trate a case where instrument shop methods were too slow, as

FIG. 6. **Torque lever, with weight, eliminates "opinion" in checking threaded parts.**

there are several diameters and also ball type bearings on the end for pull-out type engagement. Ordinarily, these would be turned with ball turning attachment between centers. To make these parts accurate and make quantities desired, the following procedure was used:

Production Methods—Tool Room Accuracy

Blank on the automatic screw machine, second operation on bench lathe, re-center, rough grind all dimensions on the O.D., grind the worm thread from the solid. Finish grind two diameters by plunge cut grinding. Finish grind the ball by plunge cut grinding. The only special tooling necessary was a micrometer adjustment on wheel dressing attachment for the ball which was developed for us by the grinding machine manufacturer. The balance of the parts are processed by simi- lar methods and careful workmanship was impressed upon operators and inspectors.

There are three parts on which the mounting threads must be qualified. Slight alterations were necessary on the thread milling machines, on which parts were threaded—with one exception. This was a 10" lathe which only required fixtures and tools. The fixtures were carefully designed and made so that parts were all interchangeable.

Master thread qualifying gauges were used to check all working and inspection gauges. To eliminate differences of opinion as to how tight to pull up after engaging faces of gauge and work, a lever (Fig. 6) is used with a weight to give the proper leverage. To attempt this operation without the above process and tooling, would be most unsatisfactory.

The assembly is done by trained operators—both male and female. No instrument makers are required by the method employed. The fitting of parts has all been taken care of by

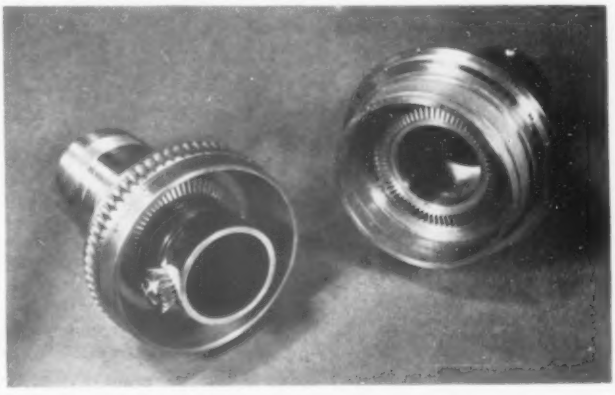

FIG. 7. **Worm and gear housings are separately sub-assembled prior to final assembly.**

close tolerance and lapping allowance. All parts are painted or finished to their respective requirements.

In most instrument work of this nature, parts are fitted, marked and then painted or plated as the case may be. Then the next step is final assembly.

The assembly is made in two sections (Fig. 7). In the mechanical assembly most parts are made into sub-assemblies. The tapers are lapped on the form gear and the shank units which have been kept in sets to this point. The dove prism holder is lapped to fit the center hole in the worm gear and the bevel pinion is lapped to fit the dove prism holder and locked. The azimuth worm is assembled to its various adapters, worm shoe and pins are set. It is then lapped in the teeth and ball socket to a smooth fit with no backlash. This fit is as good or better than a micrometer. Bevel gears are then fitted and assembled to this unit. To determine the amount of interference of the various gears and relating parts, an indicating fixture which reads directly, is used. The shank into which the lower gear fits has an allowance for facing, so as to get the proper backlash in the unit. This amount varies as to the tolerances of the mating parts and this operation takes care of all slight deviations.

The sub-assembly is then ready for an azimuth reading.

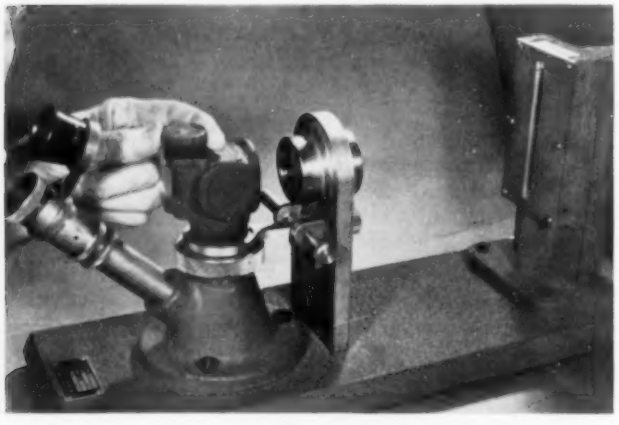

FIG. 8. Dummy prism, used when assembling rotating head, avoids injury to glass unit during this process.

backlash and horizontal plane check. This is done by using an indexing mechanism which is very accurate and a collimating telescope mounted to the sub-assembly, and revolved by the worm mechanism.

The target is another collimating unit with an illuminated reticle properly engraved. Units must pass inspection to an accuracy of 1. mil in horizontal plane, .6 mil in tooth spacing inclusive, backlash and have smooth operation.

The rotating head assembly is made with a dummy prism and finished for final assembly, at which time the glass replaces the dummy prism (Fig. 8). Thus, we avoid injuring the glass unit during the assembly process. This unit is fitted close, as movement other than that caused by turning the worm is prohibited. The reason for the dummy prism is that the holder is just a shell and all strains and stresses must be taken care of when final fits are made to the head casting. The unit is checked with a microscopic instrument of Kodak design for plumb or vertical travel, side play, backlash and total travel both sides of center. The two units then go for final assembly.

This is a large air conditioned and humidified area where absolute cleanliness is required. Dust, lint and other foreign matter including moisture are detrimental for optical assemblies. The slightest bit will cause an instrument to be rejected.

Lens cleaning plays an important part in the final assembly. This is done by using a suction system with a soft paper cone to suck up all dirt, moisture, etc., through a tapered nozzle. This does not scratch the glass.

The elbow is cleaned and all its component parts are then cleaned and dried in a small oven and immediately assembled. The reticle is then set temporarily and the unit joined to the others described above. All units are then assembled, the dove prism collimated and final tests made. These are made on another azimuth testing stand, only this time the test is made through the optical system instead of a collimator. The target is the same. Other tests are made for parallax, definition, illumination and general performance. These are all optical fixtures in common use. Heat, cold and rain tests are given a percentage of the instruments. The heat and cold tests are made in laboratory rooms that duplicate tropical or polar conditions. This is standard at Kodak, as used for photographic equipment. The rain tests are made in suitable apparatus in the final assembly department.

There are many points not covered in this article, but an idea can be gained of the difference in methods. This is only possible with production quantities to warrant the expenditure required to use method employed.

3. Tools Used in the Manufacture of the Panoramic Sight —by William R. Gordon

THE GAUGE (Fig. 9) is made up with two primary elements. First a substantial base, second, a carefully fitted master worm holding slide. Both of these are Meehanite castings thoroughly aged and accurately machined.

The slide is supported on two rows of eight ¾" steel balls which are carefully selected for uniform diameter. One row of balls is confined in Vee ways to guide the slide movement in a straight line and prevent side movement in relation to the base.

On the forward end of the slide is mounted a pair of supporting brackets to hold the master worm which is held central on carefully ground and lapped centers.

One center support is provided with a tapered locking pin which engages a slot in a two-piece driving plate, one half of which is clamped to the master worm shank. With this driver, it is possible to rotate the master worm a sufficient amount to bring the mating worm wheel into the correct position to coincide with the hair line of the microscope reticle, at which point the two halves of the driver are clamped firmly together by means of the screw provided for this purpose.

On the rear end of the slide is mounted a 1/10000 dial indicator. It is set to rest against an adjustable stop block which is mounted on the base near its center and which ex-

FIG. 9. Gauge for checking angular errors of worm gear sectors.

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tends up and through an opening in the slide which is provided for the purpose.

This indicator is used to check the setting of the worm wheel in relation to the worm, aiding in the vertical setting of the main spindle when required.

Details of Checking Gauge

At the front end of the base is located a work holding spindle with very accurately made bearings. These bearings are conical and are spaced near the ends of the support sleeve. They are of rugged construction, made of oil hardened steel ground and lapped to a perfect fit.

Between a flange at the top of the worm wheel support spindle, and the upper end of the adjustable support sleeve, is a row of 28, 3/8" diameter selected steel balls.

When lapping the spindle to its conical bearings, it was necessary to keep fitting until it rested on the balls and yet had no measurable side movement, while at the same time, it had to rotate freely and smoothly. This work required the utmost care and took time to obtain the precision necessary to gain these results.

The oil film in the conical bearings is, of necessity, very thin. On the first gauging machine we made, we encountered some trouble due to a reduction in the amount of lubricant after using the machine for a short time. This trouble caused uneven readings due to excessive friction, and the development of side play in the bearings. To overcome this, we provided pockets in the support sleeve for oil wicks. These wicks retain an abundant supply of oil and maintain a constant and uniform film on the bearings. No further trouble has been experienced since these were added.

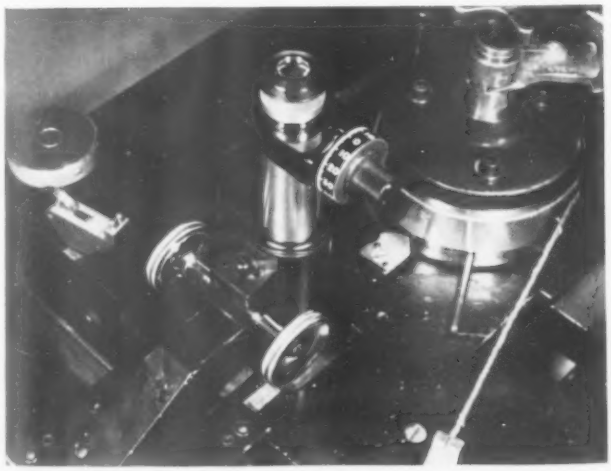


FIG. 10. "Filar" eyepiece, with dial graduated to one second readings, picks up lines of graduated ring.

At the lower end of the work holding spindle is fastened a cast bronze wheel which carries a brass ring 12" in diameter. This ring has a number of concentric lands about 1/10" wide, highly polished on its upper surface. These lands have been graduated to correspond with the number of teeth in the worm gear circle. These lines were cut with a diamond tool in a high precision dividing machine. The lines are .00025" wide.

A 100x microscope with a "Filar" eyepiece and suitable reticle was mounted on the center line of the base for picking up the lines on the graduated ring. This "Filar" eyepiece had a dial graduated to give 1 second readings (Fig. 10).

Illumination is provided by two 2 CP, 6 volt lamps which are focussed on the graduated ring below the microscope. The work spindle is provided with a grooved wheel in which is wound a small cable, the outer end of which passes over an idler pulley and is fastened to a weight. This device provides a constant and uniform pull on the worm wheel where it contacts the master worm, thus materially aiding the accuracy with which the readings are made.

The whole gauging machine sets on a rigid table and is provided with a suitable closure to protect it from dust or accident when not in use. The gauge is used as follows:
The worm gear or worm gear sector to be checked is lightly pressed on a lapped dowel that is a snug fit in a hole that is in the exact center of the graduated ring and work spindle. It is then clamped to the spindle to prevent rotative movement.

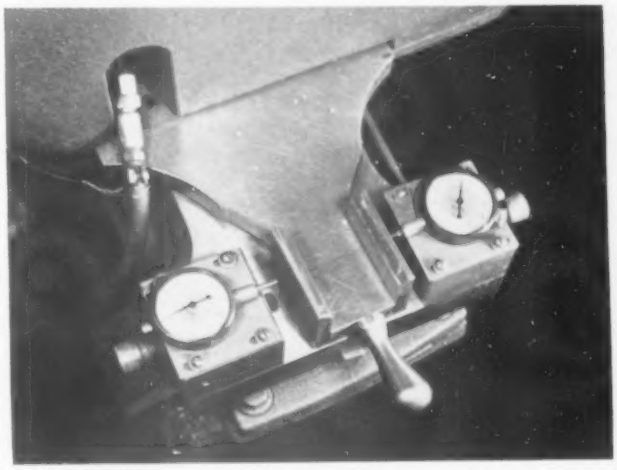


FIG. 11. By swinging the headstock of grinder, taper and bore is finished at one chucking.

The slide which carries the master worm is now moved forward until the worm meshes the correct amount in the worm gear. At this point, the vertically mounted sleeve in the front of the base is adjusted up or down as required to get the worm in the exact center of the worm wheel. This position is indicated by a maximum reading on the dial gauge mounted on the slide.

The whole base is inclined toward the front. This imparts a certain and definite pressure between the worm and worm gear and helps to give more accurate readings by the fact that the worm follows the worm wheel groove between the teeth very closely. The inclination of the base may be varied according to the work, or from experience, to obtain the desired results. The two-piece driver on the worm shaft is now loosened and the worm rotated until one graduation on the graduated ring coincides with the centerline of the microscope. The clamp screw is now tightened to lock the worm to its index plate.

We now withdraw the tapered lock pin which holds the worm index plate and rotate the worm one turn and allow the lock pin to enter and locate the worm index again at exactly 360° movement. This movement of the worm, it is noted, will advance the worm wheel and graduated ring one tooth

space, and by checking the location of the line through the microscope, we can see if the space moved is more or less than what the graduated ring calls for.

If the movement is off, the "Filar" eye piece can be adjusted to bring the lines into coincidence and a reading in seconds of arc error will show on the eyepiece dial. If the error is greater than the tolerance permits, the gear is rejected. If okay, the balance of the spaces are similarly checked.

This gauge may be used to check the error of a worm by using a master worm wheel and take the readings in the manner described, only substituting the worm to be checked for the master worm. The eccentricity of a worm thus tested will show directly on the dial gauge which is on the slide member.

Proved by Three Years Use

We have used these gauging machines for almost three years on hundreds of parts and they have proven their worth in the extremely accurate results we have obtained.

An interesting attachment made for and used in connection with a grinder for producing extreme accuracy of concentricity on the shank is shown by the photo of one of the machines used. On this part, it was necessary to have practically perfect concentricity between the bore and the taper which fits the worm gear. To facilitate doing this, we arranged to grind the taper and the bore at one chucking, by changing the grinding quill and wheel, and by swinging the headstock (Fig. 11) the correct amount to produce the required taper.

With this device, it has been possible to obtain very close work with a minimum amount of trouble.

On the shank we have an overhanding flange, the inside diameter of which fits on the gun mount. It must be held to a close tolerance because of this and also because we locate from this diameter for all of the boring, threading, and grinding operations.

On account of the locating lug at one side of the shank, a ring type plug gauge would have necessarily been quite thin and flexible.

Precision Caliper Gauge

We devised a caliper type gauge with carbide inserts with direct dial indicator reading which was quicker and gave a more accurate check on the size of the part. It also showed whether the part was over or under and to what extent, if any. This gauge is made with adjustment so it can be set with master ring to give "go" and "no go" readings at the same setting. With the use of this gauge, we have been able to speed our gauging operation and reduce our scrap losses to a minimum.

The head is a bronze casting of very thin section. To hold this firmly and without distortion, we devised a fixture to locate the work on a ground post which is located the correct amount off center to bring the worm shaft hole directly over the center of the fixture.

A bar which locates the part radially and also clamps it, is inserted in the right angle prism holder bore. The work, with this bar in place, is placed in the fixture and clamped with the hinged finger clamp which permits ease of loading. This fixture has been very satisfactory in operation and maintains the accuracy we require.

Mr. Shull has described the design and function of this telescope, the accuracy which must be maintained in both the mechanical and optical unit to meet government requirements.

Mr. Yingling has outlined the methods, processes and procedures set up to produce this instrument. Mr. Gordon has explained some of the complications in tooling for production. We now have the parts ready for assembly, the tools and fixtures to use, and the procedures to follow but—Who will assemble them?

4. Training Supervision and Unskilled Workers for Instrument Assembly—by Howard C. Wellman

WE REALIZED quickly that, in spite of the quality and accuracy required, we could not follow the method established, makers for this assembly. We did not have these people. They were not available. The time was too short to train them. The quantities wanted were too great.

We had to set up a department composed of the people available. We had at Camera Works only about half the number of people needed; some of these had had some experience in assembly work; others were clerks, stockkeepers, or transfers from other departments with little assembly experience. The remainder were supplied through the regular employment channels and included lawyers, insurance agents, housewives, school teachers—some of whom had never been in a manufacturing plant before.

Howard C. Wellman is Training Supervisor of the Camera Works, Eastman Kodak Co., in charge of training programs for supervisors. He has been with Eastman almost 25 years, including 20 years as Design Engineer of the Camera Works. He is an engineering graduate of Cornell University and took extension work at the University of Rochester.

These people had to be trained. They were going to do this work. They must know how to do their job. The better they are instructed, the better they know the job, the more they realize its importance and are interested in it, the better the results will be.

The department supervisors must do this training; they are responsible for results. To do a good job they must know in addition to their supervising knowledge: How a job should be done to produce good work. How to instruct a worker. How to spot training needs. How to keep the department running smoothly. Their relationships to each other and their place in the organization.

Special training programs helped them meet these responsibilities. The training programs of T.W.I. were most helpful. Through Job Instructor Training, they were able to analyze the jobs which the workers must do, establish a method of instruction, locate spots where training is needed. Job Relations Training helped them plan their thinking, keep things running smoothly, meet situations.

Program for Training Supervisors

A program of the basic principles of organization proved helpful in the orientation of new supervisors and helped all levels of supervision recognize their responsibilities. Real use was made of the knowledge gained in these programs. Job breakdowns of all operation were made, detailing for his information each step of the job, every important point to watch for in doing the job, the reason for doing it that way. The supervisors agree that this is the way the worker should be instructed, that everything important to him is covered, that the content is not too great or too complicated for the worker to grasp.

Breakdowns give all supervisors a uniform understanding of the job, all, therefore, follow the same pattern in instructing a worker on that job by its use. A study of the job break-

by the supervisors resulted in breaking up complicated operations into simpler components on which workers with little skill or experience could be trained. As a result, precision work was accomplished with unskilled workers by the segregation of simple operations correctly done.

A preliminary analysis of the department was drawn up showing all the different operations to be done, the number of people needed for each, when they must be available, and when they must be trained to meet production schedules. In production, the training time table keeps the supervisor advised as to the skills available, the progress of the individual worker, where he is going to lose workers, or where he needs more workers. He plans for the instruction of the worker as he plans for production. By the use of the training time table, there is less confusion among the workers, sudden changes are not necessary, the supervisor does a better job, the department is kept on an even keel.

Members of the training department work with all supervisors and aid them in making job breakdowns and drawing up training time tables. All supervisors are checked from time to time to see that they follow the prescribed method of instructing the worker. They are coached on the weak points or re-trained if necessary.

Better Supervisors—Better Workmen

So far we have been talking about how training can aid a supervisor in doing a better job. The basic purpose of a supervisor is to direct people and get work done. The basic purpose of training a supervisor is that it results in a better trained work force, and ultimately a better product. People do the work. If they do good work, we receive credit.

Most people do good work when they are properly instructed, they know why they are doing it that way, they are interested in the job, when they are given credit for it, when they feel they are treated fairly, when they are justly compensated for it, when working conditions are satisfactory.

So we see that the worker is important. Training the worker is vital; there isn't time to just let him learn. This training naturally falls in three divisions—*Induction Training, Job Instruction, Follow up.*

Induction Training is important but often neglected. These new workers, unfamiliar to the work, in strange surroundings, many of them unaccustomed to working with people or for people are jittery; they must first be made to feel at home. Their first impressions of the department, of the supervisor (who is the company to them), are lasting—we want these impressions to be favorable.

So the supervisor takes time to explain to them—The hours of work. The method of wage payment. Departmental rules and procedures which affect them.

Induction Training Program

He arouses the interest of the new worker in his job by showing him a completed instrument, briefly explains what it is for and how it works, if permissible, how accurately the parts must be made and assembled to function properly when completed. He emphasizes the importance of doing each job, however trivial it seems, correctly.

These induction programs are outlined by the Training Department to make sure that all important points are covered; we try to give as complete a picture as possible to the new employee.

Through this induction training, we assure ourselves that the worker knows—Who his supervisor is and the people he works with. The hours of work. Where to put his wraps. How to ring his time card. Where he can get his lunch. Where and when he can and cannot smoke. Where the Medical Department is located. What to do in case of fire or accident. The method of wage payment used on his job. Other departmental procedures affecting his actions.

The worker, too, has been made to feel that he is an individual; that we are interested in him; he is prepared for work. The next step is to put him to work; to teach him the job he is to do. The supervisor may review the Job Breakdown to refresh himself, to make sure he knows all the details important to the new operator. Then he instructs the worker—One step of the job at a time.

He emphasizes the important points of each step, the things that must be watched for if the job is to be done correctly. He explains the reasons for doing it that way. He proceeds only as fast as the worker can absorb the instructions. He has the workers do the job; he corrects any errors. He has the worker explain what he is doing as he does the job, what he should watch for and why. He makes sure the worker knows the job. He tells him who to go to for help.

We said the supervisor checked the Breakdown before instructing the worker. Let's see what we mean. On jobs of long duration or where many workers are doing the same operation, we employ two additional aids to fix the pattern in the worker's mind and give him a continual check on his work.

In the first,—We photograph each step of the operation as it is done. Underneath the print of each step, we denote the step and the key points. These prints are mounted in sequence on an easel and used by the supervisor as he instructs the worker. He turns from picture to picture as he covers each step. The worker reads the key points under each step and from the picture, associates them more easily with the work done.

Photographs Speed Training

This visual instruction has proved a help with slow or inexperienced workers, its use shortens the time taken to reach production levels and improves the quality of the work.

Secondly, we use procedure cards.

These are cards containing condensed information of each step and its key points mounted in front of the operator. From these cards he checks that—He is following the correct procedure; he knows what to watch for. He knows the step to step quality standards. Nothing is being omitted. These procedure cards are a definite help in maintaining procedures on long operations and maintaining uniformity of work with many operators.

However, training pays dividends only as the knowledge gained is put to use.

As the Training Department checks with the supervisors to see that the skills given them are applied, so the supervisor continually checks with the worker to see that—Established procedures are followed. The worker knows his job. Errors are immediately corrected. Best use is being made of each worker's ability. Petty misunderstandings are ironed out.

As a result, through a careful selection of supervisors, through comprehensive processing to simplify operations and utilize available equipment, through tooling designed to guarantee correctness of results, and through training aid to both supervisor and worker, we have been able to—Break up complicated assemblies into simpler operations. Instruct workers with no previous experience to do these operations correctly. Attain quality and precision with unskilled people. Produce instruments in quantities never thought possible. Maintain interchangeability of parts. Satisfy government requirements. Meet production schedules. Cut down assembly time approximately 75 %. All this was accomplished without the employment of one single instrument maker in the assembly department.

Pioneers of Mass Production

Number One of a Series

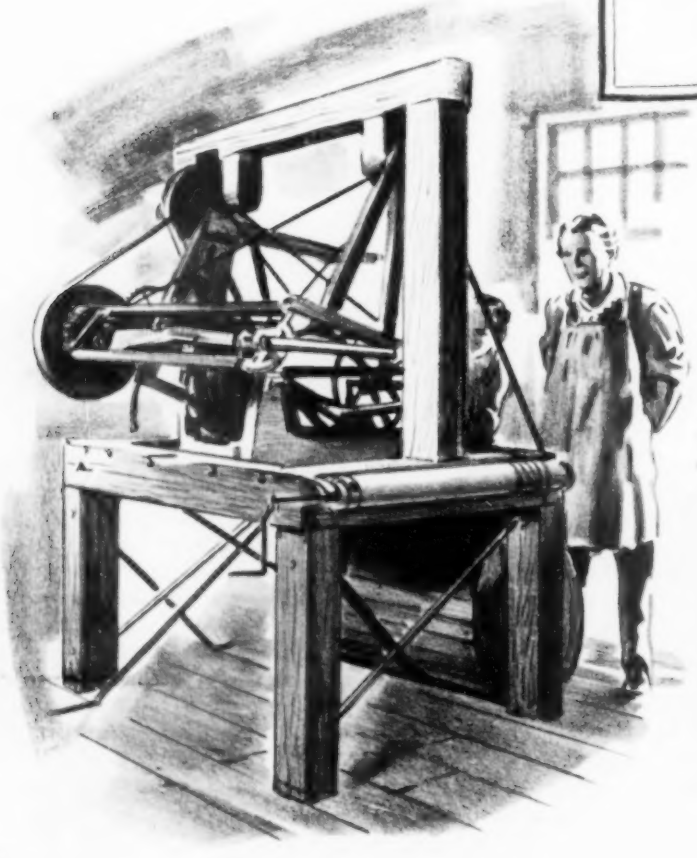
THOMAS BLANCHARD

Manufacturer of Gun Stocks

Thomas Blanchard, inventor of the first gun stock turning lathe, was born in Sutton, Massachusetts on June 24, 1788. He was the fifth of a family of six sons, and he displayed an unusual aptitude for building and contriving almost from the moment he left the cradle.

The story goes that one afternoon Blanchard, who had developed quite a local reputation for his inventiveness at building simple machines, overheard a journeyman watching a machine at work say to a shopmate, "Well, Blanchard can't take my job away from me. I am turning gun stocks."

Blanchard, as he went away, muttered to himself, "I am not so sure of that. I will think it over."



A few days later while driving homeward through Brimfield, thirty miles from Sutton, an idea for a machine to turn out gun stocks came to him.

Within a month, he had constructed a lathe which carved a neat gun stock. The contrivance was so unusual in its construction that it looked more like a machine out of the Inquisition than the first machine to produce such a highly regarded article of the times as a gun stock. The construction of the machine was quite simple. In a crude wooden frame, it included a hinged carriage to hold the feeding wheel. Opposite it was placed a cutter or carving wheel. The machine could carve two gun stocks an hour. This was more than a man carving a gun stock by hand could turn out in a day.

While Blanchard was in Washington securing a patent for his machine, he had an opportunity to exhibit it at the War Department. An admiral, interested in the contrivance, wanted to know if Blanchard could turn a "74 Frigate," a type of gun stock popular at the time. Blanchard replied in the affirmative, if given the necessary seasoned wood blocks.

Thus it came about that Blanchard in 1822 entered the service of the United States Armory at Springfield, Massachusetts and set up his first machine. It was not long before he designed and built a new model. It was smaller, finished the gun stock better, and carved gun stocks six times as fast. He was paid nine cents for every gun stock carved on his lathe.

Although Blanchard built his machine for a part of an armament of war, his basic ideas inspired other applications, and Blanchard was indeed a pioneer of mass production in this country.

By **W. E. Crotsley**

Effective Production Control

An outline of a speedy and accurate Production Control and Record System which can be adapted to many industries.

THE FIRST of the twelve subjects to be discussed is *Education in Industry*. Top management is becoming more and more interested in education and human relation policies. They are sending executives to different plants to study what is being done along these lines. Workers in industry want to advance both in position and knowledge. Company schools should be provided to give them an opportunity to study and learn other advanced occupations. This is not only beneficial to the employees but it is also beneficial to the company that employs them.

W. E. Crotsley, **Director of Manufacturing Control Education, International Business Machines Corp., is an alumnus of Wharton School, University of Pennsylvania. In addition to many I. B. M. and civic activities, he is a guest lecturer at University of Iowa. He has held executive posts with U. S. Steel, R. H. Donnelly, and Brewer-Titchener Corporations.**

Top Management will sit together and lay out the perfect plan, then, they frequently make two serious mistakes.

1. They do not educate those responsible for making the plan work. It is true that they will thoroughly explain their plan to the Works Manager, General Superintendent, Supervisors, Foremen, etc., but they do not go far enough. They seem to forget the very important part the Factory Clerks, Dispatchers and Truckers have in the overall success of their plan. Thousands of dollars are spent to plan how things should be done, and at what time they are required, yet to make the plan work, a great deal of the responsibility rests with the clerks and truckers who, in a great many cases, are never considered.

Educating—Policing—Forecasting

2. They do not appoint some one to police the plan to see that deviations from the original plan are not occurring without the consent of those responsible. Therefore, after several months, the plan fails.

The second is Forecasting. Forecasting is entirely management's responsibility. It cannot be done too thoroughly. The average forecast is too much guess work. The Sales Manager notifies the branch office to send in a list of the potential sales for the coming year. The branch managers in turn notify the salesman reporting to them. In order to be a successful salesman, one must be an optimist. The salesmen, after surveying their territory, make out their hot sheets and, in order to impress their managers, raise the figures a certain per cent. The branch managers increase the figures some more, then report to the home office. The Sales Manager is really pleased with the optimism of the field staff so he also increases the total figures.

The forecast is then sent to the factory. When actual sales orders are compared with the forecast in many cases it isn't worth the effort it took to get the figures together.

In order for industry to keep its skilled labor intact, and not have idle machine tools, it is necessary to have an up-to-date forecast, taking into consideration the trends and cycles of their business. Many concerns have learned that when the customers' orders are slowing down, instead of reducing inventories and only issuing parts orders to cover sales, it pays dividends to place manufacturing orders in the shop and with vendors for component parts only so they will be in the bins and available for assembly when their business starts on the up-grade.

This procedure applies to repetitive business only.

The Third is Sales Analysis.—It is very important that Sales Orders are reviewed for completeness and errors before they are accepted by the factory. They must be analyzed for Standard, Special and Optional features. Following this breakdown, basic raw materials, purchased parts and assemblies must be ordered. Therefore, if the information on the Sales order is incomplete or incorrect the following things can happen.

1. Over-ordering of raw materials, parts and assemblies which would cause obsolescence at a later date. 2. Insufficient ordering of raw materials, parts and assemblies causes a tie up in assembly lines at some future date.

Right now, manufacturing executives are interested in two things. (1) *Winning the war.* They realize how important it is for Industry as a whole to produce the implements of war in the shortest length of time. Therefore, they cannot take the time to start a new system.

(2) *Post War Planning.* The Production Requirements Plan and the Controlled Materials Plan have proven to management that there is a need for better control. They realize that they lack speed and accuracy. It takes too long to produce the required results by the manual method.

Post War Planning Committees have been appointed by management to get their houses in order so that they will be in a position to convert to peace-time products with the least amount of delay after the war has been won by the Allies.

They realize that competition will be keen and the ones who convert first and get their products on the market first, will start getting the business.

They are also interested in keeping unemployment at a minimum during the conversion period so that millions of workers will not be out of work.

In the course of this article, there will be considerable reference to the IBM card method of control because that is the method used (in the IBM factory) and which assures speed and accuracy.

The Fourth is Engineering Specifications (Bill of Materials)

The most important step in settting up a Production or Cost Systems is to make sure that the basic records are correct. If the Engineering Specifications are incorrect the Production and Cost Records are incorrect.

One way to find out if the Bill of Materials is correct is to give each assembly foreman enough parts and assemblies to build just one unit. If he can build the unit from the parts and assemblies delivered, the Bill of Materials is correct. If he cannot build the unit, it is then time to find out if he has been substituting other parts for those called for on the Bill of Materials. If this is the case, then two things can happen.

Keep Bill of Materials Accurate

1. Parts that were planned for certain units will not be available because they were substituted to build other units not called for on the Specification Sheets. This only applies to interchangeable parts.

2. Parts that were ordered to build certain units will pyramid in inventory because they are not being used where they were originally planned. Consequently, they will be obsoleted later on and sold for scrap.

Many industries are balancing engineering changes to establish effective date to achieve lowest scrap cost. Most changes are issued to reduce cost or improve the performance of the unit or both. This being the case, industry has an opportunity to balance the majority of their changes.

When a change is contemplated, the Engineering Department sends, to the Production Department, a list of all parts and assemblies involved on a prepared form showing Part or Assembly Number, Part or Assembly Name, Quantity In Stock, Cost Per Piece, Total Cost, Quantity in Process, Cost at Operation Completed, Total Cost, Total Cost of In Stock and In Process, At Once, Three Months, Six Months.

The Production Department posts the Quantity In Stock, the Quantity In Process and Operation Completed. The Accounting Department posts the cost figures and makes the extensions. The Production Department then shows the cost to put the change into effect, At Once, Three Months and Six Months. This information is sent to the Engineering Department and they decide at what date the change will go into effect.

The Fifth is Production Engineering

After the Engineering Department has written the Specification Sheets for the unit to be built, a copy of the Specification Sheets is sent to the Production Engineering Department. An IBM Accounting card is key punched and verified for each part or assembly shown on the Specification Sheets. The cards are then automatically sorted by the IBM Sorting Machine which arranges the cards in order by group and part number. They then constitute the Master Control File which is kept by Assembly Number, succeeded by Parts and Sub-Assemblies necessary to build the assembly, and is continually kept up-to-date as to changes.

Master Control File

The following data is punched into these cards:

Description	*Description*
Inventory Class	Size of Tracings
Group Part Number	Quantity Per Assembly
Group or Part Number	Serial Numbering Control
Part Number	Date

The Master Control Cards are used as follows:

A. To reproduce automatically, by means of the Reproducer, another set of cards called "Parts Usage Cards." These cards are filed as to cross index by part number and are kept in Production Engineering Department so that reference to the file will show every assembly the Part is used in. If changes in a part are contemplated, reference will show every assembly affected.

B. To prepare the Bill of Materials for orders and reference purposes.

C. To check serial numbers of Master Control File preliminary to explosion into parts and assemblies.

D. To prepare part number list showing size of tracing for pulling tracing from file in Blueprint Department.

E. To reproduce reservation cards from Master Control File, so that Master Control Cards can go back in file and be kept up-to-date with all engineering changes while reservation cards are processed for the actual production control.

Perpetual Inventory File

This file of cards represents at all times the current status or stock position of all parts and assemblies so that a complete manufacturing analysis of position can be had at any time. The assemblies are separated from the parts and both are filed in numerical sequence.

The file consists of the following cards.

A. *Index Card with Tab* facilitates the location in the file of the transaction cards pertaining to a part or assembly.

B. *Reservation Cards* to assure that the quantity "In Stock" or "On Order" is sufficient to meet planned manufacturing. One card showing the number of units of each part needed on each manufacturing order is prepared.

C. *Requisition Cards* to withdraw parts and sub-assemblies from sub-stockrooms and main stockrooms.

Back Order Requisitions are used to indicate stock required but not available at time of original withdrawal.

D. *Order* Cards issued at the time a part, sub-assembly or assembly order is issued.

E. *Deliveries to Stock Cards* to denote the quantity of finished parts, sub-assemblies or assemblies being delivered to the stockrooms.

F. *Make-Up Cards or Replacement Requisitions used* when parts delivered from the stockroom are found to be defective and must be scrapped or re-worked. They act as reservation cards in the Perpetual Inventory File.

G. *Credit Cards* to return excess parts from the assembly departments to the stockroom.

Inventory Cards showing the quantity in stock at inventory time, and usage for the previous year.

These cards in the Perpetual Inventory File run periodically produce the following report:

STOCK STATUS SUMMARY

Credit Code	How Made	Part No.	Available	In Stock	Reservations	Consumption Year-to-Date

Cost Code

Cost Dollars

1. Less than .005
2. .005 to .009
3. .01 to .04
4. .05 to .24
5. .25 to .49
6. .50 to 0.99
7. 1.00 to 4.99
8. 5.00 to 24.99
9. 25.00 and over

How Used Code

1. Manufactured Part
2. Purchased Part
3. Manufactured Assembly
4. Purchased Assembly
5. Raw Stores Finished Part
6. Discontinued Part
7. Discontinued Assembly
8. Obsolete Part
9. Obsolete Assembly

The Sixth is Manufacturing Analysis

The Production Engineering Department furnishes the Manufacturing Engineering Department a set of drawings and Bill of Materials. It is the responsibility of this department to determine what parts and assemblies are to be made by vendors; also in the shop. For parts made in the shop, tool designs must be made for all tools that will be required. A Transfer Operation Record is also prepared which shows the Part Name and Number and a list of the operations to be performed on the part.

Operations and Tools Planned

The list also shows the department where each operation is to be performed, the tools necessary, the type of machine tool on which the work is to be done, and the machine hour schedule on each operation.

Upon receipt of this form from the Manufacturing Engineering Department, a blue print of the drawing is requisitioned by the Production Department. With the aid of a "Raw Material Code Book" the proper numerical designation of the material to be used is noted on the form and also the unit of measure and quantity of material per 100 pieces of the finished part.

The Seventh is Preparing Operation Records, Scheduling, Starting Dates of Operations and Loading of Machine Tools.

A file of Master Operation Cards is prepared from data appearing on Manufacturing Engineering Departments instructions for most efficient manufacturing as presented in a Master Operation Record.

The Master Operation File serves as the medium for writing Operation Records and for creating cards which will facilitate scheduling and cost recording.

A Master Schedule Card is prepared showing Part Number, Order Number and Quantity Ordered.

The Master Schedule Card when placed at the head of a Master Operation Set provides a source for all data peculiar to the individual lot of parts to be manufactured. These data are combined with detail information from the Master Operation File, to produce an Operation Record directing and controlling the manufacture of a specific lot of parts.

To facilitate automatic calculation of start dates in scheduling, a schedule factor is used that is derived from the quantity and the number of hours worked per week.

The Intermediate Schedule Card is reproduced from the Master set headed by the Master Schedule Card, and serves as a medium for combining the factors common to each order for parts, such as operation data, with the factors peculiar to each lot of parts, such as quantity, schedule date, sequence number and schedule factor.

It is used as a medium for automatic scheduling, listing the Operation Record and summarizing the "Load Input Report."

Individual Labor Tickets for each operation to be performed are reproduced from the Intermediate Scheduling Cards for labor operations.

The prepunched labor tickets serve as the "Work Ahead File" in the factory departments.

When an order is entered on the factory, the corresponding set is taken from the file and reproduced to prepare Intermediate Schedule Cards. The Master Operation Set is extended in a scheduling operation on the Multiplier.

The completed Intermediate Schedule Cards are listed to prepare the complete operation record which constitutes complete authority for the manufacturing departments to proceed with the processing of the parts or assemblies.

Determining Parts Availability

The next operation is to establish a stock date from the stock status summary report. The sum of the "Credit Balance" plus the Quantity "In Stock" plus the quantity "On Order" equals the "Total Number of Pieces." The total number of pieces is divided by the number of days in the planning cycle, to compute the number of parts used per day. The number of parts used per day should be checked with the yearly consumption to date, at the time the Stock Status Summary is Prepared. The number of parts used per day should be divided into the "Credit Balance" which gives the number of days underavailable. The number of days underavailable subtracted from the total number of days in the planning cycle gives the number of days coverage.

This number of working days is added to the date when the Stock Status Summary Report was prepared to arrive at the stock date. For example:

Available	In Stock	On Order	Consumption Year To Date
1328 "CR"	2472	0	8338

1328 "CR" + 2472 + 0 = 3800 total pieces

$$\frac{3800 \text{ total pieces}}{38 \text{ pieces per day}} = \frac{100 \text{ days planning cycle}}{1328 \text{ "CR" balance}} = 35 \text{ days underavailable}$$

100 days planning cycle − 35 days underavailable = 65 days coverage

Add 65 working days to date of Stock Status Summary Report 11–1–42 equals stock date 2–3–43. (Based on twenty days per month)

Simple Stock Dating System

Stock dates are expressed by days and weeks of the year, because factory machine tools are both loaded and load relieved, by weeks. The weeks of the year are numbered 1–52 and the days of the week are numbered as follows: 0–Monday, 1–Tuesday, 2–Wednesday, 3–Thursday, 4–Friday, 5–Saturday; 6–Sunday.

Thus a stock date 1–15 would represent Tuesday of the 15th week. This system reduces the punching of the date to three keystrokes instead of six as formerly when this date would be expressed as 04–06–15 for April 6th and 15th week of the year.

Let us assume this is the stock date of the order to be scheduled by operations.

The Master Schedule Card is used as a heading card to select the Master Operation File set of cards.

The information on the Master Operation Cards is reproduced into the Intermediate Schedule Cards and at the same time, the information on the Master Schedule Card is gang punched into the Intermediate Schedule Cards, combining the factors common to each order for parts, such as operation data, with the factors peculiar to each lot of parts, such as quantity, schedule data, sequence number and sched-

ule factor, two tenths of a week allowed for set-up and transit time.

The cards are processed in a Multiplier provided with a special Production Control data computing device.

The formula is as follows:

$$\frac{\text{Quantity} \times \text{Rate per 100 pieces}}{\text{Hours per week}} + \text{Transit Time} = \text{Load weeks} = \text{start date of operation}$$

$$\frac{5000 \times .5}{50} = \text{weeks} + \text{tenths} + \text{tenths}$$

$$= .5 + .2 = .7 \text{ tenths of a week}$$

The counters in the Multipling Punch are by fifths and tenths.

Fifths	Tenths		
1	.1	115 Reverse	15.2
	.2		—.7
2	.3		———
	.4		
3	.5		14.5
	.6	Reverse	3.14
4	.7		
	.8		
5	.9		
	1.0		

The stock date is set up by the Multiplying Punch: 115. Using this procedure, the last card is fed into the machine first. The total pieces are multiplied by the rate .5 per 100 pieces, and divided by the schedule factor, hours per week, which is 50. This equals .5 of a week; plus transit time .2 of a week, equals .7 of a week. The stock date, 115, is read into the counter as 15.2 the .7 subtracts from this figure and the counter punches the start date as 3-14.

In order to change the day which is 1 into tenths of weeks the 1 is read from the fifths into the tenths and changed from 1 to 2.

After the .7 of a week is subtracted from 15.2 the answer is 14.5. The 5 is read from the tenths into the fifths and reversed from 5 to 3.

Operation Record on Same Card

This procedure of operation continues until all starting dates have been established and automatically punched into the cards. The cards are then reversed and the Operation Record is prepared on the IBM Accounting Machine.

At the end of the year, the date carry-over is as follows. A 53 week year is used.

COUNTERS

	0000.0	0000.0
Stock Date	15.2	15.2
		53.0
	———	———
	0015.2	0068.2
Scheduled Hours	0010.0	0010.0
	———	———
	0005.2	0058.2
Scheduled Hours	0008.0	0008.0
	———	———
		0050.2

The counter consists of ten digits and is divided in half. We subtract out of both sides of the counter scheduling from the left hand side until we reach the point where we are subtracting more hours than are actually available which would produce a series of nines. When this occurs, we shift to the right hand side of the counter for schedule dates. For example:

There is a 15.2 and 5.2 representing Wednesday of the 15th week and Wednesday of the 5th week, but we do not have a 68.2 or 58.2 because there isn't a 68th or 58th week.

For all cards of operations to be done per a group of machines, Labor Tickets are reproduced which act as payroll cards for the employee.

All the basic information appearing on the Labor Ticket, such as Week of Load, Part Number, Sequence Number, Operation Number, Machine Group, and Start Date of Operation, is interpreted at the top of the card.

This assures the Accounting and Production Departments that the basic information such as Part Number, Sequence Number, etc., will not be transposed, as it sometimes is when manually written on the card by a clerk.

Time is saved for the factory clerks because they do not have to write all this information on the card. It is necessary only to post the clock number of the person who is to do the job, stamp the card in and out on a job recorder, figure and post the elapsed time, and post the quantity of pieces produced.

Labor Tickets Show Load Input

The Labor Tickets are sorted by department and group of Machines and totaled on the IBM Accounting Machines to show the Load Input hours by departments and by machine groups.

Twice a month a Summary Load Report is prepared by department by groups of machines showing Department Number, Group of Machines, Type of Equipment, Number of Machines in Group, Capacity, Active Hours, Inactive Hours, Total Hours, Coverage in Weeks.

The Eighth is Machine Shop Procedure.

The Labor Tickets are then delivered to the factory clerks in the various departments where they are filed in the inactive file by groups of machines, the oldest dated job being the first card in the group.

When the material is ordered out of the Raw Stores Department for a starting department or when an order of parts moves rom one department to another the corresponding Labor Ticket is taken from the "Inactive" file and placed in the "Active" file by group of machines by start date, the oldest dated job being the first in each group.

The Ninth is Assembly Procedure.

In most industries assembly procedure does not present much of a problem. The straight line assembly is self explanatory. The Intermitter assembly requires man and woman power, Drill Presses, Riveting Machines, Welding Fixtures, etc. When an overload occurs in any department the shifting of man and woman power is the answer in many cases.

The Tenth is Cycle Checking of Inventories.

Industry is adopting a rotating inventory plan. Each day a number of items are counted and a colored tag is placed on the bin denoting that the parts have been counted and that requisitions should not be sent to the Accounting Records Department until the next day. At the end of the day the Physical Inventory Cards are punched, verified and filed in the Perpetual Inventory File. All the cards for the part numbers counted are selected from the Perpetual Inventory File and listed on the IBM Accounting Machine, showing Manufacturing Code, Part Name and Number, IBM Accounting Machine Balance, physical count and difference. Recounts are made of the bins showing large differences after which the summary cards for the differences are filed in the inventory file. This inventory reconciliation on a rotating basis allows time to locate the difference and reasons for same before the end of the year closing of the books.

One to Five Counts per Year

Management requests five counts per year of the parts costing $5.00 to $24.99 and $25.00 and over, two months apart, three counts a year for parts costing $0.50 to $0.99

(Continued on page 85)

By W. Hart Nichols

From GADGET to Stratoliner

Development of a Pantograph-type Profiling Machine for Making Accurate Model Airfoils for Wind-Tunnel Tests

BY DEFINITION, according to one dictionary, a "gadget" is a device, or object, especially one whose real name is either wholly or partly unknown. The term is used here because of circumstances concerning a problem posed in the early '20s by Prof. E. P. Warner, then head of the Aeronautical Engineering Department at the Massachusetts Institute of Technology.

Considerable research was going on, at the time, in developing the shape of airplane wings, particularly as regards their cross section. And while a designer might indulge in flights of fancy—or shall we say ingenuity?—substantiated by the few mathematical formulae then known, in trying to develop a theoretically perfect wing curve, it was difficult to obtain sufficient grants from the plane builders to incorporate these ideas into full size wings for performance tests.

To overcome this obstacle, M.I.T., University of Southern California, University of Toronto and the Army had built so-called wind tunnels in which to suspend model wings. With suitable measuring apparatus, one then simulated plane flight on a miniature scale. By this method, and test, a model would reasonably prove or disprove an inventor's claims.

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For lack of a better term, the model was called an airfoil, and the machine used for producing these airfoils was called a wing cutting machine.

Up to then, it had been customary to use wooden models for wind tunnel tests, due to the almost prohibitive cost of cutting them from metal. Wood, however, had the serious disadvantage of non-permanence in that, however well the stock be seasoned, the wing would change its shape because of the unequal amounts cut from the two sides in the shaping. Then, too, the method of mounting the wings in the wind tunnel set up vibrations that left thin wings subject to deflection. Hence, the use of metal wings became imperative.

The usual practice of producing metal wings was to rough them to shape as closely as possible on a planer or miller and then reduce them to their hoped-for correct shape by filing or fitting to templates. Their small size (the standard airfoil then being about 3″ chord and 18″ length, with a very thin trailing edge—made it extremely difficult to produce a model of sufficient accuracy to warrant a correct evaluation of the test results. The process was also very slow, a month's labor for one man being the accepted piece rate for this type of work.

Prof. Warner insisted that the cost of producing airfoils must be greatly reduced or research would be discouraged. Also, a universal machine was required, as only one airfoil of a particular design was needed to prove or disprove a theory. In this connection, the various designers were prolific with ideas until definite lines of results were indicated for concentrated refinement.

Pantograph Reproduction Method

Our approach to the problem was to use the pantograph method of reproduction applied to a milling apparatus of a very unusual form. There was no subsidy to cover the cost or development of such a machine, and the potential market for its product was extremely limited. So, using an old engine lathe bed of sufficient rigidity to absorb vibration, plus a few patterns and castings and their incidental machining, together with some Yankee ingenuity, the machine was built as shown —a monument to usefulness rather than to beauty.

A template, of either hard wood or steel, and six times the size of the finished model, was produced by laying out the ordinates and abscissa from the designers' calculations by an extremely accurate process. This template rotated with the wing blank, which was of rectangular cross section and fed continuously through a set of close fitting jaws, in the form of an aperture, by means of a lead screw and nut. Thereby, a helical cut was performed on the blank for as much as 36″ of length for an airfoil with a 6″ chord.

The ratio of 6-1 was followed throughout the design of the machine, the following wheel for the template being 18″ diameter, the milling cutter 3″. The same proportion held for the linkage arms and the rocker shafts or bell cranks. A later refinement was to add a second milling head to rough out the blank ahead of the finishing cutter, both heads and cuts running simultaneously 180 degrees from each other with relation to the circumference of the blank.

An arrangement was also built into the machine to increase the angular velocity of the template and blank at the leading and trailing edges, where, because of the extreme

(Continued on page 54)

The Common Sense of Tooling

By Charles Marvin

TOOLING IS NOT a mystery, but a combination of knowledge and good sense. In the aircraft industry, strength and performance are not the only items which must be designed into an airplane. Visibility, armament, crew or passenger comfort at sea level and at altitude, are all problems for solution. Maintenance and productivity are also factors. Along with the factors of performance, the airplane must be designed so that its fabrication and assembly can be accomplished without undue strain on either the plant's equipment or personnel. This is where tooling men who have an appreciation of the aircraft engineers' problems can aid the engineering department in designing parts and assemblies which, everything considered, can be most easily tooled and manufactured. Here again common sense and appreciation of the other fellow's problems are vital factors.

Once a design is accepted, however, it is the responsibility of the tooling department to set its vast tooling machine into motion. It must be ascertained whether the time or cost element is of prime importance. Inasmuch as we have a number of methods of tooling to produce identical parts, some of which cost more and take longer to tool, but allow a more economical cost for the fabrication and assembly of the parts, and others which cost less and take less tooling time, but again reflect in the piece price by increasing the cost, it is necessary to determine the logical course. And when this decision is made it must not be changed since, even though subsequent ideas may prove superior, a mediocre idea well executed is much better than several good ideas partially developed. It is self-evident that, if all personnel involved concentrate on one idea, that a greater degree of production can be obtained, even though the idea is mediocre, than by separating up into several groups, each championing what is thought a better idea, with nothing being accomplished.

Tools Must be Fool-Proof

The most variable factor in any production set-up is the mechanic. No two men work alike; indeed, one man does not turn out consistent work from day to day. This is apparent when mating parts are being fitted together. These facts must be kept in mind when designing tools. They should be as foolproof as possible. At this point one can imagine fuselages, wings, tail surfaces, etc., all converging and being fitted together to form the completed airplane. All sub-assemblies must align without undue trouble, and this is the final proof of the accuracy of the tooling design and construction. Yet, a perfect tooling program must do more than this. If the above accuracy is obtained, and if the tools give a production

...me so that the flow of parts and sub-assemblies to the ... assembly line is according to schedule, then the tooling ...rtment may feel that its job has been well done.

One question is that concerning the number and types of ... to be used. Thus, to produce a given unit, should one ... one major assembly jig and several sub-assemblies? Or, ...veral major jigs, eliminating the sub-assembly jigs? Or ...uld it be better to use several of each? Should one set of ...ling be used or must sets be duplicated? What degree of ...akdown should be introduced into a production scheme? ...n answer to these questions is basic to formulating the tool- ...g program, and the answer is common sense tooling.

These and many other questions which arise in the process ... tooling cannot be recalled from the vast amount of "know ...ow" stored back in the deepest recesses of your mind, but ...ust be met with a practical solution derived from clear ...hinking as imbued by the particular need. Often the solution ... one of the most difficult problems may come from a person ...nskilled in the tooling profession. That is the reason why we ...t Consolidated Vultee Aircraft encourage constructive think- ...ng on the part of all of our employes, not alone those in key ...positions. Cash suggestion awards are made to employes for ...workable ideas.

Pooled Ideas—Better Tools

The planner usually originates the tool line-up; however, in order that all angles may be covered, the department which is to use the tool is contacted on any new, difficult or different types of parts or assemblies. On receiving an order, the tool department proceeds to develop the tool. In most cases this is done in tool design with the shop constructing it as designed. Again in some cases, where the process is new, the tool research group would be assigned the job of developing the tool. Tool research works in cooperation with the tool planner and the shop department concerned. Such experimenting and trying of ideas as is necessary will be carried on until the tool is perfected.

There is always a good deal of this developing on new or special tools going on, with the results very successful, satisfactory, or failing. But then, "Nothing ventured, nothing gained." An organization which remains static and does not develop new and better methods will soon be surpassed by more energetic outfits.

In some cases, the original idea for a tool will come as a verbal suggestion from some individual in the plant. He may be an expert mechanic or a clerk from another department. But his eyes have been open and his mind working. It's good common sense tooling to realize that although you are an expert in your field, workable ideas may come from those who know very little about your job.

Ever-Changing Tool Program

Tooling is a never-ceasing challenge. Time brings with it new industrial developments and designs, and with each new design come new problems to the tool engineer. New designs have been accelerated by the war, and when Uncle Sam is your best customer and is fighting a world-wide battle, it becomes evident that production schedules must be met.

Often it becomes necessary to "put the squeeze" on tooling employes in order to retool for design changes over which the tooling department has no control. Then it is good common sense to take your employes into your confidence and let them know why the rush is on.

Once a decision has been reached through intelligent discussion of a problem, that decision must be followed until proven wrong. Every member of the tooling team must work toward the same objective. No team can consistently win when it must rely on one or two stars, and concentrated effort on the part of all of your employes will reap more production than grandstand playing on the part of an individual. Team work always pays off.

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The three main factors which usually determine whether tools or parts are to be manufactured or purchased are: the availability of machines, shop manpower and division policy. Once this policy has been determined, information is channeled to the planning department where planning sheets, assembly station lists, and parts planning lists are made. These instructions are used by the various departments of the plant, including production and inspection departments. From this planning form, tool control writes the various tool orders, schedules the completion date on each in accordance with a predetermined shop manufacturing schedule, and follows-up to see that schedules are adhered to. Even after the completion of the actual tool itself, the maintenance, both from an engineering change and use standpoint, must be continued as long as the project is current.

The tooling department may be divided into two main subdivisions, each headed by a tooling superintendent. One subdivision is comprised of planning, tool design, project tool engineers. The other subdivision is comprised of the tool fabricating departments; namely, jigs and fixtures, tool and dies, pattern shop, template and plaster shop and foundry. Justification for this broad subdivision is found in that the responsibility for the planning, the design of the tools and the making them work is rested in one group. By bringing these together under one head, many controversies, which otherwise would slow up the progress, are eliminated. In putting the fabrication shops under one head, the task of utilizing manpower, equipment and other facilities is made easier.

Plan for Constant Improvement

In addition to these main divisions of the tooling department, there are other sections, such as tool and work control, rivet tooling, tool inspection and tooling research. In tool research new methods are developed in advance of actual design requirements in order that the tooling department may be ready with the right answer at the right time. Through the tooling inspection section flow all tools made in the department. Here they are checked against existing information for accuracy.

The problem of coordinating this large and complex set-up is indeed great since, on a modern four-engined bomber, it is necessary to construct approximately 27,000 manufacturing tools as well as many items of reference tooling which are used in the construction of these tools. Here, the tool liaison group, under the project tool engineer, plays an important part. It is their job to anticipate shop trouble before it happens and by means of tool engineering changes, keep production rolling. There is no short-cutting in the tool department. It's a combination of planning, hard work and common sense. Whether or not your individual needs require such a set-up is of course for you to decide. And common sense must be applied in order that the given job can be accomplished well.

Mistakes may occur; if so, admit them. Only try not to make the same mistakes twice. Here, the words of Abe Lincoln may apply as a motto for the tool engineer: "I shall try to correct errors where shown to be errors, and I shall adopt new views as fast as they shall appear to be true views."

Tooling is not always successful. There are many heartbreaks. However, it is good thinking to rule out the word "if" and scratch out the word "alibi." We may have forty million reasons for failure, but not a single excuse.

ANDYGRAMS

AT THE MOMENT of jotting down the preliminary notes for the Column, the rising curtain of the New Year augurs, if not entirely new, at least—be it hoped—broader vistas. For, my bridges are burned behind me; I have left the plant, with its roar and clatter, for the calmer(?) atmosphere of the Editorial office. My connection with *The Tool Engineer,* previously avocational, now portends a full-time job.

I say portends, because my only reason for accepting was a hope that, thereby, I might render a greater service to the Society and, incidentally, to industry. Time will tell. Yet, while I start the job with the confidence native to a *tool engineer,* and further bolstered by the overt good will of my fellow members, I must confess to a wrench of heart when it came to breaking old ties. Ten years association with Midland Steel and the old *Tool Engineer* staff closely coincides with my membership in the A.S.T.E.

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ANOTHER PARTING imparted its wrench. My son-in-law, Clarkson J. (Bud) Mogford, left a few hours ago for a port of embarkation after a brief furlough. A fine American boy, clean cut and athletic, Bud has quite entrenched himself into our hearts. We have come to regard him as our son, and we now know, at first hand, what it means to send *the boy* "over there."

Not, of course, that we men waxed sentimental. Just a handshake, but fraught with understanding. "Come home with your shield, Bud . . ." As for the women—well, at the moment they are gravely regarding horizons that lie far, far beyond the immediate ken. Even the three-year-old Cyclone —that's my granddaughter—has subsided, lulled by the spell of the Sandman. Okay, Bud, do your job and don't worry about your loved ones. Between us, we'll keep the home fires burning.

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TIME FLITTING, I am now at H.Q., pounding out copy with both fingers after a round of introductions with Charley Hasse, office manager. Met Frank Wilson, come to edit the A.S.T.E. Handbook. He'll do. A phone call from Prex Burnside, asking if I'd had my feet on the desk yet. As my first visitor, past Prex Joe Siegel, come to donate an ash tray. And I've quit smoking—almost!

The first Sunday of '45 was a day of rest when, after attending a memorial service for a boy whose plane had plummetted into the North Sea, I just loafed and got reacquainted with the family, the dog included. A rather novel experience for a guy to whom leizure, for the past decade or so, has been just an Utopian dream. Maybe I'll get fat!

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A phone call from Pete Dubois of Swartz Tool Company, but whether to tender congratulations or condolences I couldn't quite make out. Both may be in order. We've palled around, Pete and I, and insulted each other, since the early days of the A.S.T.E., only he dropped out a couple of years back. Better come back into the fold, Pete. The Society is as friendly as ever; besides, I want my old friends around me.

JERRY MARSHALL, Exec. Sec'y of the Association of Engineering Companies, also called up. Nice chap, Jerry, likeable and friendly. In this connection, I would personally like to see a closer bond between all engineering groups, and to that end have frankly espoused a federation of engineering societies. There should, of course, be equal representation, the delegates to convene and decide issues of import to the body as a whole.

Fortunately, the trend is that way. The A.S.T.E., with its various Chapters, has long held joint meetings with other engineering groups, with benefit to all. And on January 12th, at a meeting held at Hotel Book Cadillac, Detroit, representatives of the Society were invited to convene with the S.A.E. and the A.S.M.E. to discuss *Standards of procedure in drafting room practice.* And that is but one of many interlocking interests.

Eventually, we'll have a federation, perhaps to include engineering groups from all over the world. In an age of world unrest, such a federation would be a powerful, stabilizing force—a force for international morality. For the world of science—and engineers move in that world—knows no hatreds, admits of no rivalries except as friendly emulation is a spur to progress. It is committed to human advancement, not to exploitation of the many by the few.

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AS FOR OURSELVES, we are going to stick to A.S.T.E. fundamentals—to *Tool Engineering.* The tool has been the basis of all manufacture from the Stone Age through to this Machine Age. Without tools, be they simple jigs or compound fixtures, the colossi among machine tools or the plants that house them, there could be no mass production as that term is ordinarily understood. And *tool engineering* has become an exact science that, demanding the ultimate in Know-How and mechanical ingenuity, embraces the entire category of mass manufacture.

As *Tool Engineers,* we are important units in our composite industrial, economic and social structure. The name, Tool Engineer, is one that we can be proud of, a good and fitting title for the men who have "tooled the nation"—yes, and the arsenal of Democracy as well. In war as in peace, *the Tool Engineer is the key man of industry.* Remember that, and "on with the A.S.T.E."

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LAST NIGHT, helping to put the book to bed, I had my first chance to really get acquainted with Bob Powers—that's the executive editor—and his staff. They're okay!—doing a swell job. As for the improved *Tool Engineer,* I've had my nose too close to the grindstone for anything but a superficial idea of what it was going to look like. But now!—well, gentlemen, it's not bad. Nossirs, not bad! But, judge for yourselves; as for me, I'm right smack against my last ●

Andy

By **Dr. John J. Caton**

The Philosophy of the Engineer

The engineer can take a cue from Benjamin Franklin whose keen interest in man as well as in materials made him one of history's most educated men.

BENJAMIN FRANKLIN was not perhaps in all respects a paragon, but he was unquestionably a polygon—a plane figure with many sides and angles. There were not enough buttons on his black coat to tell of the multifarious aspects in which his complex personality was presented to the world. He was a craftsman and tradesman; philosopher and publicist; diplomat, statesman and patriot. And he was, withal, a very human being. What concerns us particularly here is the fact that he was at once philosopher and man of affairs and father of American Engineering. His remarkable career should refute forever the fallacy, which, unfortunately, is still current, that the man of science is temperamentally unfitted for the practical business of life.

Dr. John J. Caton, recently retired Director of the Chrysler Institute of Engineering, has had 42 years of experience in engineering education and practice. He holds several engineering degrees, is a member of the Franklin Institute in Philadelphia and of the Royal Society in England, and holds many patents on railroad and electrical equipment.

At the time when Franklin was in England the British Parliament was assumed to be composed of representatives of three estates: the lords spiritual, the lords temporal and the commons; but Edmund Burke, pointing to the reporter's gallery, said: "There sits a Fourth Estate, more important far than they all." No one at all familiar with the ubiquitous influence and the all-pervading power of the press would today question the validity of Burke's appraisal. Even then, however, there was present in England in the person of Benjamin Franklin, a prototype and exemplar of the membership of a Fifth Estate, an estate destined to play an even greater part than its predecessors in the remaking of the world.

What Is the Fifth Estate?

This Fifth Estate, to which your attention is appropriately invited, is composed of those having the simplicity to wonder, the ability to question, the power to generalize, the capacity to apply. It is, in short, the company of thinkers, workers, expounders, and practitioners upon which the world is absolutely dependent for the preservation and advancement of that organized knowledge which we call Science and Engineering. It is their seeing eye that discloses "the inner harmony of things; what Nature meant." It is they who bring the power and the fruits of knowledge to the multitude who are content to go through life without thinking and without questioning, who accept fire and the hatching of an egg, the attraction of a feather by a bit of amber, and the stars in their courses as a fish accepts the ocean.

The curious deterioration to which words are subject has left us with no term in good repute and common usage by which the members of the Fifth Estate may properly be characterized. Sophists are no longer distinguished for wisdom; they are now fallacious reasoners. Philosophers, who once claimed all knowledge for their province, are now content with speculative metaphysics. Scholars have become pupils. The absent-minded and myopic professor is a standardized property of the stage and screen. The expert, if not under a cloud, is at least standing in the shade. In Detroit one hesitates to call a professional man a scientist; he may be a Presbyterian; and a "sage," as an anonymous writer has pointed out, "calls up in the average mind the picture of something gray and pedantic, if not green and aromatic." Let us, therefore, for a time at least, escape these derogations and identify ourselves as members of the Fifth Estate.

Who Comprise the Fifth Estate?

Although the brotherhood of the Estate is open to all the world, its effective membership nowhere comprises more than an insignificant proportion of the population. Two hundred and fifty constitute the membership of the National Academy of Science. The latest edition of "American Men of Science" includes only about 9,500 names. The number is expanded to 12,000 on the roll of the American Association for the Advancement of Science. Although gathered from all countries, and though chemistry is one of the most active and inclusive of the sciences, the chemical papers, books and patents reviewed in Chemical Abstracts in 1923 were the product of about 22,000 workers. One may hazard the estimate that there are not in all the world 100,000 persons whose creative effort is responsible for the advancement of science.

The studies of Cattell indicate that in America, at least, the great majority of men of science come from the so-called middle and upper classes, or precisely those sections of society which in Russia have been practically exterminated in the name of the new social justice. In about two-thirds of

Cattell's reported cases, both parents were American-born, while the fathers of nearly one-half were themselves professional men. Seventy-five per cent are dependent upon the universities for support, from which we may assume that the burden of the higher surtaxes does not bear heavily upon the Fifth Estate.

Initiative is one of the rarest mental qualities; yet without it progress is impossible. Its combination with the scientific inmagination and command of fact is still rarer and more precious. Since comparatively few of those who study science develop the capacity to extend its borders, the cost of a man competent to advance science has been estimated at $5,000,000, and his value to the community set at a far greater figure. Full membership in the Fifth Estate thus seems to involve the highest initiation fee on record. It is a figure disconcerting to the candidate, but as Wiggam has finely said: "Only genius can create science, but the humblest man can be taught its spirit. He can learn to face truth."

That the Fifth Estate is not better appreciated or always understood by the world at large is not surprising. In their endeavors to secure accuracy of definition and expression, its members have evolved a preposterous and terrifying language of their own. It is not ideally adapted to the interchange of confidences in ordinary human intercourse. It does not lend itself to poetry. A primrose by the river's brim is much more than a yellow primrose to the botanist: it is a specimen of Primula vulgaris. The organic chemist produces a synthetic product in a mass of pilular dimensions and bestows upon it a name that would slow up Arcturus.

Nothing but static interference can account for the terms of radio telephony. If knowledge is to be humanized it must first be translated.

Vision and Open Mind Essential

Now vision, a trained intelligence and an open mind are the qualities which characterize all those who are worthy of membership in the Fifth Estate. They are qualities which the many-sided Franklin possessed in exceptionally high degree.

Among all the activities with which his busy life was crowded, Franklin undoubtedly found his greatest pleasure in the pursuit of science, and in that pursuit he followed the electric method. At a time when nearly everything awaited explanation, his focused attention ranged like a searchlight over many fields. He observed the movement of winds and developed a theory of storms. He considered ventilation and the causes of smoky chimneys and proceeded to invent new stoves. He introduced the Gulf Stream to Falmouth skippers and demonstrated the calming effect of oil on turbulent seas, to officers of the British Navy at Portsmouth. From earthquakes he turned to the heat absorption of colored cloths and the fertilizing properties of gypsum. He wrote on sun spots and meteors; waterspouts, tides and sound. The kite, which for centuries had been the toy of boys, became in Franklin's hands a scientific instrument, the means to a great discovery. That its significance is, even now, not universally appreciated is shown by the recent answer of a schoolboy, "lightning differs from electricity because you don't have to pay for lightning." To Franklin, we owe our intitial conceptions of positive and negative electricity, and he was the first to suggest that the aurora is an electric phenomenon.

The gregariousness, which is a prominent characteristic of the Fifth Estate, found early expression in Franklin. He formed The Junta, a club for the discussion of morals, politics, and natural philosophy, and in 1744 drew up a proposal for the organization of the American Philosophical Society, of which later he became president. He established a wide acquaintance and cemented many firm friendships among the foremost scientific men of France and England, by whom he was received on equal terms.

Franklin was a man of science, but his career proclaims that it is possible to be a man of science and much more besides. Science was made for life, and life is more than science. Art in its fullest expression may touch deeper springs, human relations and affections may bring richer rewards, and public affairs may make a more imperious claim. With Franklin as their prototype, the members of the Fifth Estate may well strive to emulate his devotion to the public service and his broad and constructive interest in human problems and affairs.

Error and misconception have a feline tenacity upon life, and the Fifth Estate, though richly endowed with latent executive capacity is still in popular opinion regarded as equipped for thought rather than for action. The practical man, busily engaged in repeating the errors of his forefathers, has little time and less consideration for the distracting theories and disconcerting facts of the man of science. Yet the true man of science is usually a man of action, too.

Fifth Estate Has Recast Civilization

With less political influence than the sparse population of Nevada, the Fifth Estate has recast civilization through its study and application of "the great and fundamental facts of Nature and the laws of her operation." It has opened out the heavens to depths beyond imagination weighed remote suns, and analyzed them by light which left them before the dawn of history. It has moved the earth from the center of the universe to its proper place within the cosmos. It has extended the horizon of the mind until its sweep includes the 30,000 suns within the wisp of smoke in the constellation Hercules, and the electrons in their orbits within the atom. It has read the sermons in the rocks, revealed man's place in nature, disclosed the stupendous complexity of simple things, and hinted at the underlying unity of all.

Because of this new breadth of vision, this lifting of the corner of the veil, this new insight into the hidden meaning of the things about him, the mind of man, cramped for ages by taboos and bound by superstition, is emerging into freedom: into a new world, rich in promise, and of surpassing interest and wonder.

Man brought nothing into the world, and through long and painful ages he added little to that nothing: a club, an axe of stone, a pebble in a sling, some skins of beasts, a rubbing of sticks for a fire. He might labor, but to what avail? Even today the South American Indian works incessantly, yet his labor produces little more than heaps of stones. To those who would have us believe that all wealth is produced by labor, the Fifth Estate replies, "Wealth is the product of brains, and labor is productive only as it is guided by intelligence."

Science is the great emancipator of Labor. Bagehot has somewhere said that during the early stages of civilization, slavery was essential to progress because only through the enforced labor of the many could the few have leisure to think. Today, in the United States the supply of available energy is equivalent to sixty man power for every man, woman, and child. There is now leisure for all to think, but millions prefer the movies.

Controls Stupendous Forces

It is not Labor, but the trained intelligence of the Fifth Estate which has endowed man with his present control of stupendous forces. It has solved problems that for ages have hindered and beset mankind. It has revealed great stores of raw materials, synthesized scores of thousands of new compounds, furnished the fundamental data which find embodiment in machines and processes, and in those agencies of transportation and communication that have made of the world a neighborhood. It has enabled man effectively to com-

t disease, has added years to the average life, and has made at life better worth the living.

Benjamin Franklin died in 1790—one hundred and fifty-ve years ago. Could he return to make appraisal, what won-ers would confront his astonished vision, what triumphs of he Fifth Estate compel his admiration!

Electricity, which to his contemporaries was little more han an obscure force, the curious manifestations of which night supply an evening's entertainment, has become the tructural basis of the universe. The atom of Democritus is ow a microcosm, vibrant with energy that glows in the white ight of the electric lamps which have replaced the tallow dip. Instead of electrophorus and the charges of the Leyden jar, he would find in our own country alone, twenty-seven million horsepower driving generators in thousands of stations, from which electric energy is distributed to our homes, factories, and transportation lines to perform innumerable services. Imagine, if you can, the stunning impact of the impressions that would crowd the day of his return. With what amazement would be converse over a wire from Philadelphia to San Francisco or hear a voice transmitted through the ether from a point halfway around the world. So commonplace a thing as a street-car would leave him open-mouthed with wonder, which might well increase at the sight of an electric locomotive, hauling its thousands of tons of freight.

Where once the post boy and the post chaise were familiar, he would find our streets crowded with automotive vehicles and the country gridironed by the railways. Should he wish to send a letter across the continent, he would have only to commit it to the air mail to ensure its arrival in thirty-six hours.

The gardeners Franklin knew grew peas for pleasure or profit. Mendel grew them and established the laws of heredity. Farming, which was a wholly empirical occupation, is now the special concern of a great governmental department devoted to the development of scientific agriculture. Here Franklin would learn of soil analysis and seed selection, of hardier and more prolific varieties of plants, or better breeds of animals, of methods of control of such virulent diseases as splenic fever, anthrax, hog cholera, and bovine tuberculosis. He would find his own experiments with gypsum extended to cover the whole field of chemical fertilizer, the air itself converted into an inexhaustible reservoir of plant food, and the efficiency of farm labor multiplied many times by ingenious agricultural machines.

Fifth Estate Has Made a New World

He would find household economics revolutionized: the town pump replaced by running water; electricity; a servant in the house; the food supply broadened and stabilized; domestic drudgery assumed by laundry, bakery and factory; tasteful clothing within the reach of all; transportation and amusement for the multitude, and the history of yesterday sold for a penny. Innumerable new industries, based on the findings of the laboratory, now offer the means of decent livelihood to millions and open careers to thousands.

With discoveries and developments such as these to the credit of so comparatively small a group of men—contributions to human welfare which have so enriched and stimulated the intellectual life; which have brought the people of the earth together into closer touch than English shires once were; which have revolutionized industry, enlarged the opportunity of the average man and added so greatly to his comfort and well-being—we may reasonably inquire, "What are the recompenses of the Fifth Estate?"

On the material side they have almost invariably been curiously inadequate and meager. It is comparatively more profitable to draw The Gumps for a comic supplement than to write "The Origin of Species." There is more money in chewing gum than in relativity. Lobsters and limousines are acquired far more rapidly by the skillful thrower of custard pies in a moving picture studio than by the no less skillful demonstrator of the projection of electrons. The gate receipts of an international prize fight would support a university faculty for a year.

One may recall that Lavoisier was guillotined by a republic that "had no need of a chemist"; that Priestley was driven from his sacked and devastated home; that LeBlanc, after giving the world cheap alkali, died in a French poorhouse; that Langley was crushed by ridicule and chagrin in his last days. A month before the war who could have believed that within a few years the Fifth Estate in Russia would be utterly destroyed and in Germany and Austria existing at the very edge of starvation? What has happened there may happen again elsewhere if the intelligence of the world does not assume and hold its proper place in the direction of national and world affairs.

One is reminded that Carlyle, on the authority of Richter, says: "In the Island of Sumatra there is a kind of 'Light-chafers,' large fire-flies, which people stick on spits, and illuminate the ways with at night. Persons of condition can thus travel with a pleasant radiance, which they much admire. Great honour to the fire-flies, but————."

Professional Earnings Increase Slowly

It is not becoming that the world expect the light to shine indefinitely, when carrying a lantern is often less remunerative than carrying a hod. The money and the years of study required for special training from a decade of research is often taxed as the income of a year. Professional salaries move forward as slowly as a glacier, but they seldom leave a terminal moraine. Yet teaching is our most important business, for a failure to pass on for a single generation the painfully accumulated knowledge of the race would return the world to barbarism.

Though material wealth is rarely acquired by the Fifth Estate its members have the riches of the royal man, defined by Emerson as "he who knows what sweets and virtues are in the ground, the waters, the plants, the heavens and how to come at these enchantments." Their wealth is in the Kinglom of the Mind. It is inalienable and tax-exempt. It may be shared and yet retained.

A recent survey by a national magazine would seem to indicate that the majority of men have drifted into their vocations with little effort of selection, and that a very large proportion ultimately regret their choice. This is seldom true of members of the Fifth Estate. Theirs is true vocation, a calling and election. It brings intellectual satisfaction more precious than fine gold. They live in a world where common things assume a beauty and a meaning veiled from other eyes, a world where revelation follows skillful questioning and where wonder grows with knowledge. Together they share the interests, the communion of spirit, the labors and the triumphs of the fraternity of science. The law of diminishing returns exerts a control from which there is no escape in agriculture, industry, and business. Research alone is beyond the twelve mile limit of its inhibitions.

Science Offers More Than Material Benefits

If "the Heavens declare the glory of God," that glory is surely made more manifest by telescope and spectroscope. If the whirling nebulae and the stars in their courses reveal omnipotence, so do the electrons in their orbits reveal His presence in universes brought into being by the striking of a match. The laboratory may be a temple as truly as the church. The laws of nature are the will of God, their discovery is a revelation as valid as that of Sinai, and by their observance only

can man hope to come into harmony with the universe and with himself.

There has been a ready and general acceptance by the world of the material benefits of science, while its contributions to sociology and ethics as guides to human conduct are as generally ignored. Yet science proclaims new commandments as inflexible as those engraved on stone, and furnishes what Wiggam has reverently termed "the true technology of the Will of God."

Science has so drawn the world together and so rapidly remoulded civilization that the social structure is now strained at many points. State craft and politics, law and custom lack the plasticity of science and are not in imperfect contact with the contours of their new environment. The result, as events have shown, is friction and confusion. Though our civilization is based on science, the scientific method has little place in the making of our laws. Office does not seek the man in the laboratory, and candidates are not pictured as engaged in any activity that might suggest a superior intelligence. They are shown milking cows, pitching hay, in new blue overalls, or helping with the family washing. Recently, in the senate of a New England state, there was presented the edifying spectacle of the presiding officer being shaved by a barber, who had been called to the rostrum, while senators were reading the encyclopaedia into the record. To expedite further the public business, sundry members of the chamber were presently gassed with bromine. Does not this suggest that a few chemists might with advantage be distributed among our legislative bodies?

Knowledge and Power Inter-Dependent

It is claimed that 50 percent of the members of state legislatures of America have never been through high school, and that only one in seven has been through college. We see in the ranks of science knowledge without power, and in politics, power without knowledge. An electorate, which regards itself as free, listens to the broadcast noise of manufactured demonstrations and is blind to the obvious mechanics of synthetic bedlam. The result is too often government by gullibility, propaganda, catch-words, and slogans, instead of government by laws based on facts, principles, intelligence and good will.

As President Stanley Hall once said, "Man has not yet demonstrated that he can remain permanently civilized." Many thoughtful people have been led to question the ultimate effect of science upon civilization. We all recognize the utility of matches, but we keep them away from children. Meanwhile, science puts dynamite and T.N.T., poison gas, aeroplanes and motor cars at the disposal of criminals and the leaders of the mob.

"Knowledge comes but Wisdom lingers," and Democracy levels down as well as up. Even in Boston, cigars have replaced books on a corner famous for a century of literary associations. The world is wrong because few men can think. It will not be made right until those who cannot think trust those who can. When its foundations are so obviously out of joint, humanity still clings tenaciously to fossilized precepts and opinions and is as resentful of suggested change as in the days of Galileo. Despite the pressure of new ideas, education must still, to be acceptable, follow old conventional lines.

Though we go from here to happy homes, let us not deceive ourselves. Human life is still a hard and fearsome thing. Mankind is required to maintain existence in a world in which, as Kipling has said "any horror is credible." More than a hundred years ago DeQuincy wrote, "We can die, but which of us, knowing as some do, what is human life, could, were he consciously called upon to do it, face, with shuddering the hour of birth." But little more than yesterday Henry Adams closed his "Education" with the expression of the hope that perhaps some day, for the first time since man began his education among the carnivores, he would find a world that sensitive and timid natures could regard without a shudder.

New Horizons for Science

Everywhere there is upheaval and unrest. "The machine," to quote Dr. Elton Mayo, "runs to an accompaniment of human reverie, human pessimism and sense of defeat." We are everywhere overburdened by unnecessary illness, crushing taxation, extravagant and inefficient governments, huge expenditures for trivialities, and the appalling waste of effort, material and resources. We are hampered by class suspicion and misunderstanding, racial antagonisms, the inhibitions of organized labor, and the lack of imagination in high places. Life in general is on a low cultural plane and bound by custom and tradition.

One hundred years of science have failed to satisfy the craving of humanity. Chesterton finds science "a thing on the outskirts of human life—it has nothing to do with the centre of human life at all." We do not, of course, agree with him, but we must still meet the challenge of John Jay Chapman, who declares: "Science, which filled the air with so large a bray, is really a branch of domestic convenience, a department for study of traction, cookery, and wiring. The prophet-scientists have lived up to none of their prospectuses." The fault, however, as Wiggam points out, is not with science, nor with the scientists. It is with those who "have mainly, used the immense spiritual enterprise of science to secure 5-cent fares, high wages, and low freight charges," when it should have "ushered in a new humanism."

Thus we still encourage race deterioration, still carry the burdens of the unfit, still cultivate natural antipathies, and still are breeding from poor stock and witnessing with equanimity the suppression of the best.

The history of aristocracies, feudalism, the church, the guilds and the soviets has amply demonstrated that no one class possesses the qualities required for the government of all classes, and we cannot claim them for the Fifth Estate. We can, however, claim with full assurance that the Fifth Estate possesses many qualities, now practically ignored, which could be utilized in government to the advantage of us all. It is knowledge of material facts, of natural and economic laws, of the factors governing race development and human relations; and its imagination, vision and its open mind should be brought to bear effectively in the formulation of National policies and the solution of governmental problems. There is an alternative before us, which was defined several years ago with somewhat surprising frankness by the head of one of our most conservative labor unions:

"But until labor, in the inclusive sense in which I am using it, secures control of legislative and executive branches of the national and state governments, and through control of the executive branch secures control of the judiciary, labor is in continuous peril of seeing its gains wiped out and its program retarded by hostile legislation or unfriendly court decisions."

Our countrymen may well consider whether they prefer participation in government by the Fifth Estate to the benefit of all or control of government by labor unions in the interest of labor.

Most Troubles Spring from Human Nature

Since most of the troubles that beset mankind have their origin in human nature, it would seem worth the while of those who make our laws to study and apply the findings of the biologists and psychologists as to what human nature really is and what are the springs of its motivation.

Plato called democracy "the best form of bad govern-

(Continued on page 54)

Operator Fatigue Means Production Sag

ONE big obstacle to peak production is operator fatigue. Every turret lathe department head knows how production falls off as operators become weary and tired. Chucking pieces—heaving on a wrench handle to tighten chuck jaws . . . tugging again to remove the piece takes a lot out of the best of operators.

At the C. L. Gougler Machine Company, Kent, Ohio, the turret lathes equipped with a Warner & Swasey Power Chuck Wrench will outproduce the machines without one, by 30%. Operators may be equal in strength and skill—machining operations and turret lathe models may be identical—but the Power Chuck Wrench makes the difference.

The Steel Improvement & Forge, Cleveland, are taking off more metal at higher speed and show a big increase in production because Power Chuck Wrenches save many minutes on each chucking, and firmer grip allows heavy cuts at speeds formerly impossible with hand chucking.

At the National Acme Company, Cleveland, the job is fast machining on light pieces—aluminum and magnesium alloy metals. Operators are continually chucking and removing pieces every two or three minutes. This would be man-killing work by hand chucking. Power Chuck Wrenches, with pieces instantly gripped by the turn of a knob, are making the job easy for operators, and these Power Chuck Wrenches are given full credit for the big increase in production figures.

See What Warner & Swasey Power Chuck Wrenches Can Do on Your Machines

We urge that you talk to your Warner & Swasey representative about getting Power Chuck Wrenches on your current model Warner & Swasey turret lathes. On war production they will pay for themselves in short order. For postwar competition they will be a necessity. Better look into Warner & Swasey Power Chuck Wrenches now—so write. Warner & Swasey, Cleveland, Ohio.

YOU CAN MACHINE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

WARNER & SWASEY · CLEVELAND, OHIO

TURRET LATHES, SADDLE AND RAM TYPES—CHUCKING AND BAR TOOLS—TAPPING AND THREADING MACHINES

58 OPERATIONS

AND ONLY 1 GRINDER

DoALL PRECISION GRINDER

Maximum efficiency, minimum machinery!

A successful midwestern manufacturer of Vernier Calipers, Height Gages and Squares uses only two pieces of machinery . . . A DoALL Contour Machine to cut the shapes, a DoALL Grinder to finish the entire output!

58 distinct grinding operations are required in the finishing of the 24" calipers alone; the DoALL Surface Grinder does them ALL with speed and utmost precision, demonstrating again its remarkable versatility for all types of grinding.

The lower illustration shows two dozen caliper jaws being ground at the same time.

Write for literature which gives full specifications of the DoALL Grinder.

THE GRINDER WITH CREDENTIALS

Each DoALL carries a Test Bar and Performance Tag giving the micro-inch finish the grinder produces.

DoALL

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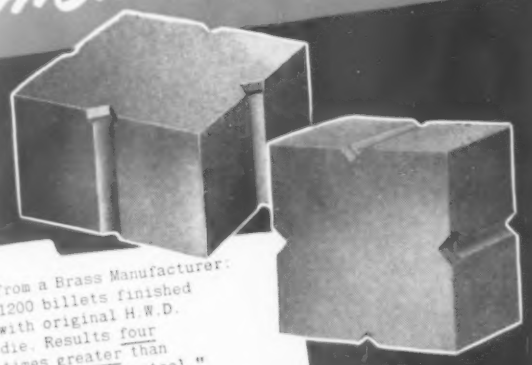
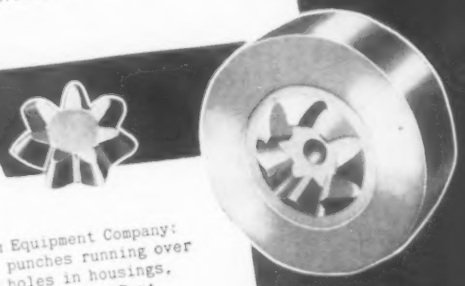
HIGH PRODUCTION RECORDS TELL THE STORY



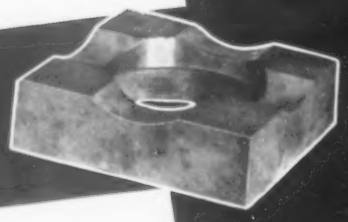
from a Brass Manufacturer:
"1200 billets finished with original H.W.D. die. Results four times greater than with any other steel."

from a Forge Company:
"operating record on H.W.D. tests shows 7000 above average of any other steel."



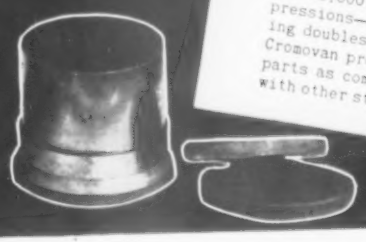
from an Equipment Company:
"H.W.D. punches running over 50,000 holes in housings, and still running. Best previous record with other steel dies 20,000 holes."

from an Automotive Manufacturer:
"975,000 pieces between grinds averaged by Cromovan dies."



from a Steel Drum Manufacturer:
"150,000 barrels per die—average production of seamer rolls of Cromovan Die Steel for heading steel barrels."

from a Wheel Manufacturer:
"original Cromovan die good for 25,000 brake drum impressions—and re-conditioning doubles its life. Cromovan produces 2500 hub parts as compared with 1500 with other steel dies tried."



H W D
DIE STEEL
For Hot Work

Performance sheets picked at random give assurance that Firth-Sterling quality die steels will meet your particular high output problem with record-making satisfaction. H.W.D. Hot Work Die Steel provides exceptional toughness, wearing quality and stability. It is recommended for general hot work operations involving severe pressure or impact, including forming, forging and die casting. For detailed operating information, write for H.W.D. Bulletin SL-2014.

The Firth-Sterling line includes six other hot-work die steels

CROMOVAN
DIE STEEL
For Cold Work

Where production in big figures is required, Cromovan is the preferred die steel. It is particularly adapted to cold work and offers the outstanding features of improved machinability, high abrasion resistance, unusual depth of hardness (preventing sinking), and minimum dimensional change during hardening. Used for cutting and forming dies, and for many special operations where conditions are unusual. Send for a Cromovan Bulletin SL-2022.

The Firth-Sterling line includes six other cold-work die steels

ARMY-NAVY

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STEEL COMPANY

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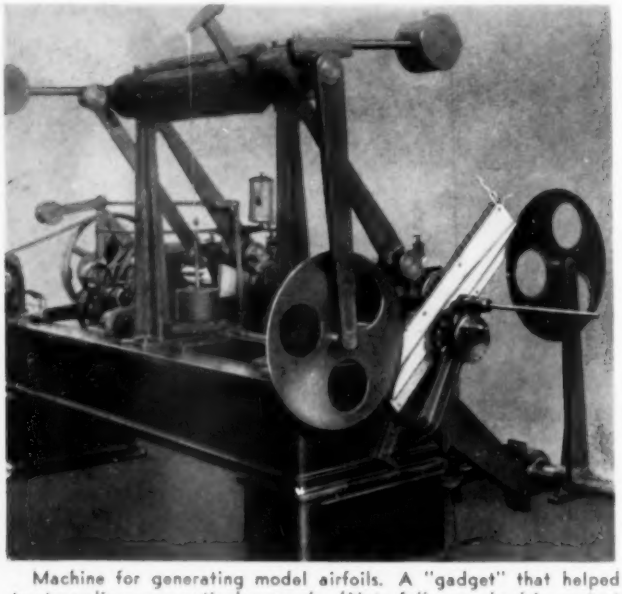
(Continued from page 41—"*Stratoliner*")



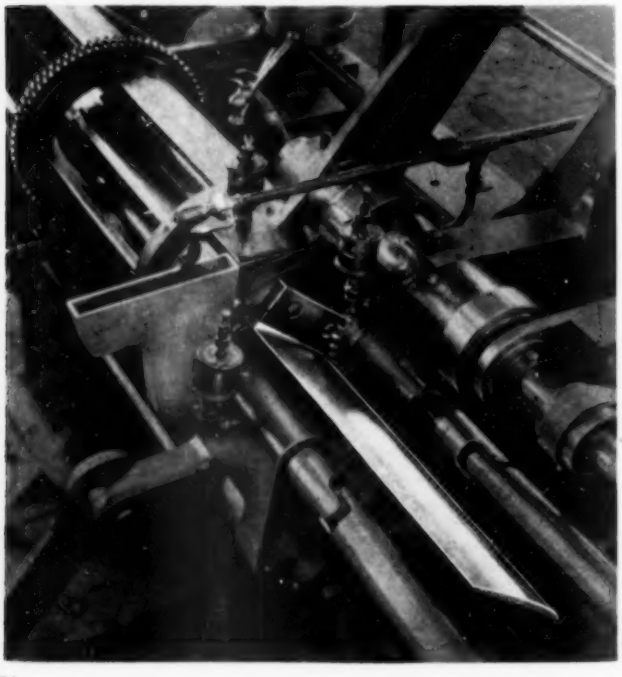
Machine for generating model airfoils. A "gadget" that helped to streamline aeronautical research. (Note follower wheel in contact with template).

elongation of the form to be cut, the ratio of linear velocity of cut to angular velocity is low.

This method of producing an airfoil reduced the overall time required to approximately 1/15th. of the former manual process. Furthermore, the accuracy of the finished airfoil, by virtue of the 6-1 reduction in any error in the template, represented a marked advantage in test results contrasted with the previous use of wooden or hand made models. For instance, it was felt quite possible to lay the template points within approximately .001", giving a theoretical error of layout transmitted to the finished model of less than .0002"—which, of course, is common shop language today.

That, briefly, is a condensed description of a "gadget" which made an important contribution to aeronautical research and which, possibly, contributed much to the predominant position that our Air Arms now enjoy in the present world struggle.

Close-up view, showing model wing—or airfoil—as slinding through chuck jaws and as being milled.



(Continued from page 48—"*Philosophy*")

ment." It will be the best form of good government only if it develops the capacity to breed leaders and the faith to trust them. The quality of our children will determine the quality of our democracy. If our laws and mores and economic structure continue to discourage breeding from our best strains, if there is to be no adequate recompense for service of the higher types, the time is not far distant when democracy will no longer be safe for the world. If the Fifth Estate were everywhere to be wiped out, as it has been in Russia, the result would be vastly more calamitous than universal war.

Oswald Spengler, in a recent monumental work, forecasts the downfall of western civilization and would prove his thesis by the history of past cultures. But never in the past has man lived in so compact a world, never has he had such facilities for inter-communication with his fellows, never has he been endowed with such control of natural forces. He has never known himself so well, and, above all, never before has he had it in his power to direct so definitely the course of his own development. Our civilization is certainly imperiled, but there will be no downfall if mankind can be taught to follow the light already before it. As lantern bearers, it is the clear duty of the Fifth Estate to show the way. In the past the world suffered grievously from lack of knowledge; today it suffers from its rejection of mis-application. Could the springs of human conduct and the affairs of peoples now be regulated only as wisely as we know how, there would be work and leisure and decent living for all. The criminal, the defective, and the feeble-minded would be breeded out, and sane minds in sound bodies breeded in. The loss and suffering from preventable disease and accident would not be tolerated. Higher standards would govern the selection for the public service.

We *CAN* Plan a Better World

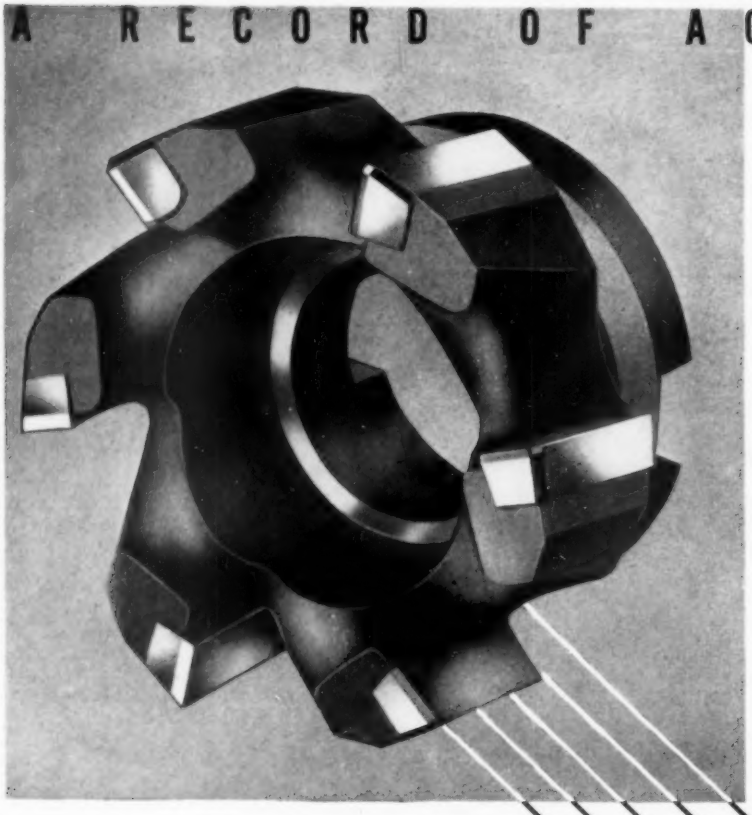
Planning would replace cut and dry development, and a rational conservation check the reckless waste of our resources. Production and distribution would attain to levels of efficiency altogether new, and the many injustices now existent in human relations would well-nigh disappear. With the reaction of a freed intelligence on politics, religion, and morals, we might hope for a broader tolerance, a better mutual understanding. With the recognition of the spirituality of science and the divinity of research and discovery, should come larger interests and a new breadth of vision to the average man, and to us all an acknowledgment of the steadfast, purposive striving shown in the development of the created world, together with a reverent appreciation of man's privilege to aid and further this development.

Replace Ugliness with Beauty

We might reasonably expect ugliness to be replaced by beauty in our cities and small towns, and later even in our homes. Government by intelligence for the general good of all should supersede government by special interests, bloc, faddists and fear of organized minorities and the uninformed crowd. With it all would come relief from the economic pressure which bears so heavily upon the Fifth Estate that its children, which should be counted among the best assets of the community, are now a luxury.

The world needs most a new tolerance, a new understanding, an appreciation of the knowledge now at hand. For these it can look nowhere with such confidence as to the members of the Fifth Estate. Let us, therefore, recognize the obligation we are under. Ours is the duty and the privilege of bringing home to every man the wonders, the significance, and the underlying harmony of the world in which we live to the end that all undertakings may be better ordered, all lives enriched, all spirits fortified.

A RECORD OF ACHIEVEMENT



TANTUNG
Blue Streak
SHELL END MILLS

FIVE SIZES
2¼" 2½" 3" 3½" 4"
DIAMETERS

COMPARATIVE CUTTING PERFORMANCE

	HIGH-SPEED STEEL	TANTUNG BLUE STREAK
S. F. M.	80	145
R. P. M.	76	136
FEED	3½"	5½"
DEPTH OF CUT	¼"	¼"
PIECES PER GRIND	2	16

MATERIAL CUT: Hard Nickel-Chrome-Molybdenum-Steel. Machine: Kearney & Trecker, Model K, 7½ HP. A coolant was used. Conventional cut.

YOU CAN GET THE SAME RESULTS! Tantung is easy to sharpen. Easy to operate. Use same technique as for high-speed steel cutters, only increase RPM and FEED. Write for Bulletin V-R 338.

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Guide

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Also described are many types of small cutting tools—built to form metal in accord with today's accurate dimensional standards and close tolerances.

The PM Diamond Emblem on all of these gages and tools is your guarantee of initial accuracy and extra care used in finishing and hardening.

If you have not already received your copy of the new catalog, a request on your company letterhead will bring one to you.

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In metals, the quality of the product is determined by the x-ray, Brinell hardness and other tests for fatigue, tensile strength, etc. In diamonds there is no simple way to TEST the hardness and suitability of a stone.

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- an OCTAHEDRAL diamond in a Sta-kool or other single-point tool for truing and dressing grinding wheels.
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- MANY SMALL diamonds for use in core bits, selected for their sharp rock-cutting edges.
- WHOLE diamonds, reduced by special process to diamond powder of even grit for use as powder and as the abrasive agent of diamond wheels for sharpening the now popular carbide tools.

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Detroit manufacturer* of aircraft parts increases production 450%

They used to hone one bushing per minute—and then they had to stop and clean out left-over abrasive. Now they finish-ream 4½ bushings per minute, to mirror-smooth finish and close tolerance in only one operation! The Lempco Expansion Reamer has many outstanding features. 500% greater expansion range, plus the fact that removable blades may be re-sharpened 8 to 10 times, enables one Lempco Dual-Spiral to ream as many different size holes as 6 to 8 conventional expansion reamers. Blade segments may be replaced in 30 seconds. Flutes spiral in opposite directions simultaneously, eliminating chatter and producing a perfect finish. Good delivery. *Write for catalog.*

SPECIAL REAMERS DESIGNED
TO MEET YOUR NEEDS
SEND BLUEPRINTS

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4½ per minute instead of only 1 per minute

SOLD SEPARATELY
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The shop which builds a variety of products in varying size lots, needs something much more flexible than the conventional type of precision boring machine. It must be able to handle jobs both large and small with a minimum of set-up and change-over time. It must be quickly aligned, equipped with an accurate method of spacing holes and a quick means of changing speeds and feeds.

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A SIMPLEX 3U Knee Type Precision Boring Machine is here shown with an indexing fixture for precision boring several parts in a heavy transmission. The hole sizes differ, so a quick means of changing speed is of great advantage. Various fixtures are used which can be made of the most desired proportions and the machine adjusted to suit the work. Boring and facing feed changes are quickly and conveniently made by means of the star knobs on the bed. All controls are within the operator's easy reach. One of the most valuable features is the fact that when once set up for a job, operation is reduced to loading and unloading the work and pushing the starting button. Let our representative study your work and tell you more of the many advantages of these advanced designs.

Precision Boring Machines

STOKERUNIT CORPORATION

SIMPLEX Precision Boring Machines and Planer Type Milling Machines

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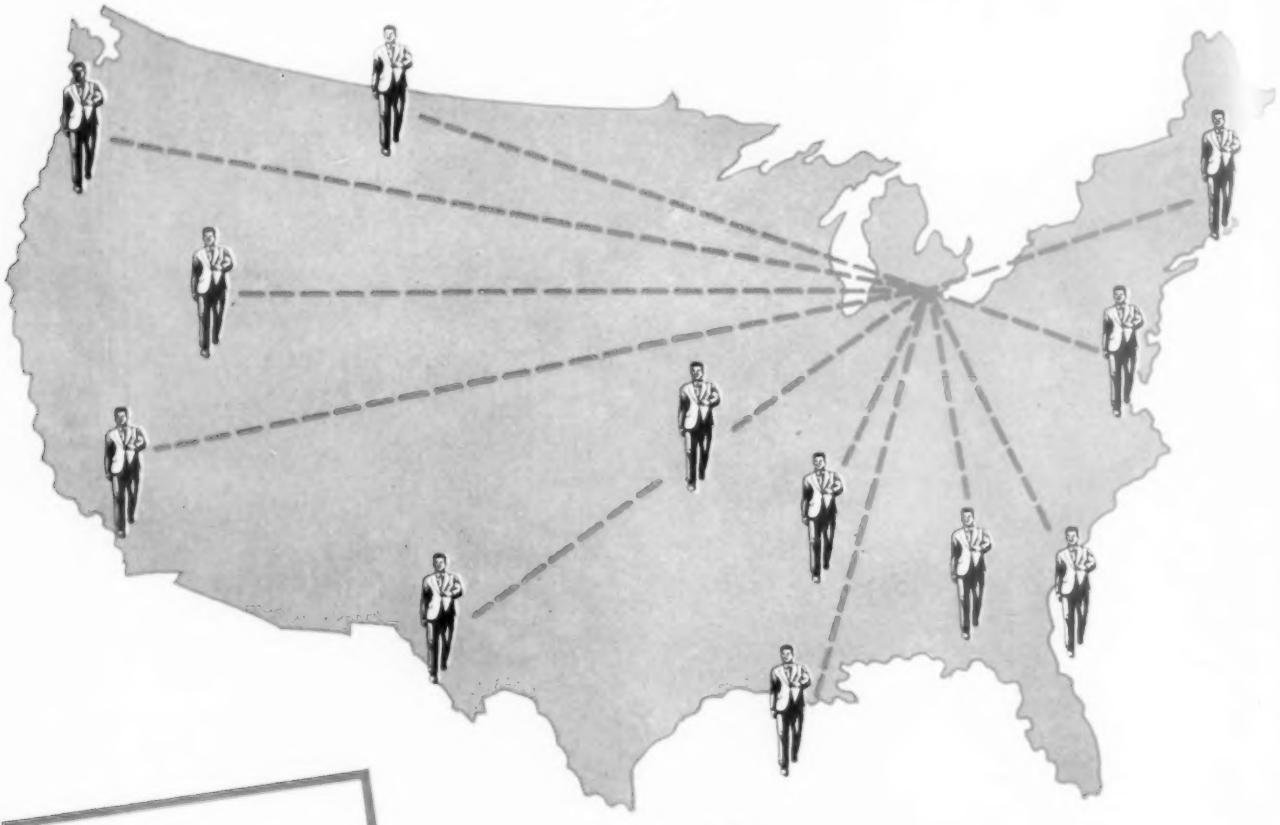

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NATIONAL SERVICE ENGINEERS are strategically located in every section of the country. These highly-trained specialists have had years of experience in dealing with all types of problems concerning cutting tools and their uses.

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A.S.T.E. NEWS

NEWS OF INTEREST AND ABOUT MEMBERS

Public Relations Chairmen Responsible For Chapter News

Detroit, Mich. — Reminders to Chapter Public Relations Chairmen to realize the seriousness and importance of their office, in promptly reporting activities of their Chapters and members, for publication in the *ASTE News* section of *The Tool Engineer*, have been issued by National Public Relations Chairman G. J. Hawkey and his Co-Chairman A. F. Denham.

Their communication reads, in part. "As you know, your Society has assumed the publication of its magazine, *The Tool Engineer*, beginning with the February issue.

"Coincident with this new publishing setup, you have become a news reporter for the re-styled publication. All Society news, including accounts of Chapter meetings, appears in a special section which is an enlarged edition of *ASTE News*.

"The amount of publicity your Chapter and its members receive will be in direct relation to the quantity and quality of material which you submit. No great editorial ability is required—simply an account of what took place, relating newsworthy items —human interest notes, highlights of your speaker's address, special events on your program, distinguished guests present. The actual copy will be staff-written at National Headquarters. Photographs (glossy-prints preferably) should accompany stories, whenever possible, to add interest to the text matter and to make the paper attractive.

"News about individual members should also be reported—promotions, changes of business affiliation, interesting extra-curricular activities, obituaries, and so forth. (Try to secure a photograph of the member concerned).

"Publication of the new *Tool Engineer* on the first day of the month—almost a week earlier than the average date of issue under the former contract—makes it necessary for Chapter news to reach Headquarters by the 15th of the month preceding publication. The earlier the stories arrive, the more complete and interesting their contents, the better coverage they will receive. Announcements of coming meetings must make the same deadline.

"Let's have every Chapter accounted for in each issue of *The Tool Engineer* published by ASTE."

The new forms for reporting meetings and submitting announcements of coming meetings, which Messrs. Hawkey and Denham included with their instructions, are being received from Chapter Public Relations Chairmen in encouraging quantity and quality.

PRESIDENT'S LETTER

Members of ASTE:

With the appearance of the February issue of The Tool Engineer—the first which has been its direct responsibility—your Society has entered the publishing field.

D. D. Burnside

The Society has assumed financial obligations for materials and supplies, for editorial and advertising staffs, to produce an outstanding publication in our field — one attractive in design and pleasing to read—with timely technical articles and other pertinent data.

ASTE is employing an editor for the "Tool Engineers' Handbook," a man eminently qualified to produce with us a manual of information directly applicable to our fields of activity.

Up to the time it was decided to postpone the National Technical Meetings and the Tool Engineering Industrial Planning Exposition, your society was actively preparing for the most ambitious technical program in its history. Much of this preparatory work will of course bear fruit later, when it is again possible to hold such meetings and expositions.

Finally, your Society is maturing, and is assuming its obligations —professional, technical, educational, and social—in the national economic picture. Each of these projects is expected to be at least self-supporting. While your Society is now solvent and operating within its income, additional burdens, because of new commitments, can easily put us in the red, unless additional revenue is available.

In consideration of all of the above-mentioned factors, your Board of Directors has voted, nearly unanimously, to adjust the annual membership dues, effective January 1, 1945, to $10.00, Senior, and $6.00, Junior.

You, as a member, will take pride in the fact that the Society; to which you contribute your support, has, through its Board of Directors, inaugurated its expanded program and has, in addition, exhibited the acumen to insure its financial stability.

D. D. BURNSIDE, *President*
American Society of Tool Engineers

Headquarters Expanded For New Projects

Detroit, Mich.—Removal of the National Office from its former location at 2567 W. Grand Boulevard to a newly-finished wing of the Penobscot Building—Detroit's Empire State —was effected November 1st with little interruption of office routine.

The staff, now completely departmentalized, is housed in individual offices, each devoted to a separate phase of ASTE activity. The suite, laid out according to the Society's specifications, commands a view of the Detroit River with its ceaseless war-borne cargoes of coal and ore tonnage exceeding that of the Panama and Suez Canals combined.

Far below in the other direction is spread the kaleidoscopic spectacle of Campus Martius—a famous crossroads whose daily traffic is greater than New York's Times Square—and probably as cosmopolitan. (It is said that every spoken language is heard in Detroit.)

New National Address

The Penobscot Building, Detroit's tallest skyscraper, houses the Society's Headquarters on its 16th floor.

Situated in the heart of the financial, transportation, hotel, office supply, printing and retail districts, it is expected that Headquarters operations will be greatly facilitated, particularly during the current man-power shortage prevailing in all fields.

Three daily deliveries and 23 pick-ups by the Post Office three floors below, replacing the irregular and infrequent service furnished at the former

(*Continued on page 66*)

A•S•T•E *NEWS*

A Publication of the American Society of Tool Engineers

1666 Penobscot Bldg.
Detroit 26, Michigan

Editor, Adrian L. Potter
Associate Editor, Doris B. Pratt

"Headquarters" (*Continued*)

location, will hasten the dispatch of our voluminous mail. Incidentally, this thirteenth-floor Post Office—the highest in the world—has the smallest staff and handles the fourth largest mail volume of any Detroit station.

A considerably-enlarged receiving and shipping room will make it possible to assemble and distribute data sheets—an operation which has been performed by an outside contractor, because of inadequate office space. This change alone will offset considerable overhead expense.

Editorial offices for *The Tool Engineer* and the "Tool Engineers' Handbook" are also being provided at the new address, consolidating all our projects under one roof. A committee room is available for special meetings of the Board, the National Executive Committee and other groups.

The much-needed expansion is in line with the tremendous increase in membership and the subsequent demands for service made upon the Detroit office.

Members are invited to inspect the Society's new home, and enjoy the panoramic view of the city included in the building's conducted tours to the 47th floor.

Handbook Editor

Schenectady, N. Y.—Announcement of the selection of Frank W. Wilson, Copy Chief, Catalog and Directory Division, McGraw-Hill Publishing Company, New York, as Editor-in-Chief of the Tool Engineers' Handbook, has been made by E. W. Ernst, Handbook Committee Chairman.

F. W. Wilson

The decision of Mr. Ernst's committee, whose name was changed from "Publications Committee," by the Board at its recent meeting, reached only after interviewing and considering many applicants, has the approval of the National Executive Committee.

Mr. Wilson has been associated with McGraw-Hill for thirteen years—the last three of which have been spent in the planning and preparation of catalogs for the country's leading manufacturers. Although he graduated from New York University with a degree of B.S. in Industrial Engineering, he has always leaned toward industrial advertising rather than plant operations.

The new editor assumed his duties January 2nd at National Headquarters where contributions for use in the Handbook may be submitted

Coming Meetings

BUFFALO-NIAGARA FRONTIER—February 15, 7:30 P.M., Buffalo Trap and Field Club. Speaker: Mr. Henry D. McLarty, McLarty Business Films. Subject: "Ultra High Speed Motion Pictures and Their Application To Industry and Research." Coffee Speaker: Lt. Gertrude Lund, WAC, will talk on "Parts Women Have Taken In War."

COLUMBUS—February 14, 6:30 P.M., Fort Hayes Hotel, Spring and Front St. Speaker: Mr. A. J. Langhammer, President, Amplex Div., Chrysler Corp., Detroit. Subject: "Machine Parts Made From Powdered Metal." A cordial welcome is extended to all members of other Chapters visiting Columbus.

DAYTON—February 12, 8:00 P.M., Democratic Club, 121 S. Ludlow. Speaker: Mr. George D. Webber, President of Webber Gage Company, Cleveland. Subject: "Angle Block Checking."

FORT WAYNE—February 14, Chamber of Commerce Bldg. Annual Election of Officers and entertainment.

LOUISVILLE—February 13, Kentucky Hotel.

RICHMOND—February 13, 6:45 P.M., Richmond Leland Hotel, Richmond, Ind. Speaker: Mr. George D. Webber, President of Webber Gage Company, Cleveland. Subject: "Precision Gage Blocks."

SPRINGFIELD, (MASS)—February 12, Highland Hotel. "Gilbert & Barker Night." Speaker: Mr. Fred Whitcomb, Deepfreeze Div., Motor Products Co., Chicago. Added Feature—a new film by Sikorsky Helicopter Aircraft.

TOLEDO—February 17, Toledo Yacht Club. Dancing—Entertainment—Smorgasbord.

TORONTO. February 12, Dinner 7:00 P.M., Meeting 8:00 P.M. Malloney's Art Gallery, 66 Grenville St., W. Speaker: Mr. Al Baumgartner, Sales Engineering Executive, The Cincinnati Shaper Co., Cincinnati. Subject: "Press Brakes and Tools." Film: "Meehanite," sponsored by Meehanite Research Institute, New Rochelle, N.Y.

WESTERN MICHIGAN—February 12, Park Congregational Church, Grand Rapids. Speaker: Mr. John W. Kinsey, Field Engineer, Micromatic Hone Corp., Detroit. Subject: "Honing."

Convention and Exposition Indefinitely Postponed

Acting voluntarily to help relieve the domestic transportation crisis, the Board of Directors of your Society has decided to postpone indefinitely the Tool Engineering Industrial Planning Exposition scheduled for the giant Cleveland Auditorium in March, together with the National technical sessions scheduled to be held simultaneously. President D. D. Burnside accordingly sent the following telegram to James F. Byrnes, Director of War Mobilization:

> "The American Society of Tool Engineers in full agreement and sympathy your program. By action of its Board of Directors has authorized summary postponement of virtually completed Tool Engineering Industrial Planning Exposition scheduled for Cleveland in March. This action will relieve transportation facilities of added burden of several thousand executives and engineers in addition to more than 17,000 Society members.
>
> "The Society is assuming all obligations at hand for commitments already made in connection with this exposition recognizing the need for interchange of technical production information must be deferred to the immediate crisis."
>
> D.D. Burnside, President
> American Society of
> Tool Engineers

We all appreciate the educational and other values resulting from attendance at our National expositions and technical meetings. We all know that the dissemination of knowledge in the field of Tool Engineering, by any legitimate means, is our constitutional duty and obligation, which is discharged through the publication of our journal, *The Tool Engineer*, the issuing of engineering data sheets, and our attendance at national meetings and expositions.

However, we all realize today that the needs of the war effort outweigh the needs of the Society—and so the Cleveland Show and Technical sessions have been indefinitely postponed, basically because of transportation and housing difficulties.

Our National Membership Annual Meeting, as prescribed by our Constitution, is held each March coincidental with the Meeting of the Board of Directors. In compliance with those prescribed regulations and to complete the corporate records, the Annual Membership Meeting will be held March 23 and 24 at Detroit.

Tool Engineer's Technical Editor

Detroit, Mich.—With this month's issue of *The Tool Engineer*, the ASTE's Andrew (Andy) Rylander has been appointed Technical Editor of the Society's Tool Engineer. Look for his inimitable chitchat column, "Andygrams," found elsewhere in ASTE News.

"Andy" Rylander

Mr. Rylander's experience in industry has been broad and varied—in plants from New England to Texas. For the past 22 years he has been located in Detroit, his most recent connection having been with Midland Steel Products where he served as Master Mechanic.

"Andy" also has a long and active Society history, having been one of the earliest Secretaries of Detroit Chapter, a member of its Standards Committee, National Director, and, for the past several years, Chairman of the National Editorial Committee. He has relinquished his business activities to devote all his efforts to his editorial post at National Headquarters.

SYRACUSE CONVENTION GLIMPSES

American Machinist Photos

Semi-Annual Meeting, Syracuse

1. James Y. Scott, Banquet speaker, lends an ear to Mayor Thomas E. Kennedy.
2. Otto Winter, National Education Chairman, (left) chats with Dr. Mark Ellingson, William F. Patterson and E. M. Bertschi, Tool Engineering Education speakers.
3. Canadian Plant Session Leaders—Left to Right: Edward Kennard, L. G. Singer, R. Eric Crawford, W. A. Dawson, and E. N. Wearn.
4. Jam session following one of the technical meetings.
5. Magnesium Session Group—Left to Right: Otis E. Grant, C. J. Wiberg, G. N. Morceau and Max Judnich.
6. Chairman C. G. Newton shepherds the Eastman Kodak speakers before the camera. Left to Right—W. R. Gordon, P. G. Yingling, F. M. Shull and (extreme right) H. C. Wellman.

Headquarters Opens New Departments

Detroit, Mich.—The constantly increasing number and variety of services rendered by the Chapters Service Bureau of the National Office made it so unwieldly that it was recently necessary to realign it into two new departments—Program and Public Relations.

Program operates under the direction of the Chairman of the National Program Committee, L. J. Radermacher, who will make recommendations on speaker and film information before it is distributed to the Chapters.

A new list of speakers, now being compiled, will shortly be available; literature describing recent film productions is being gathered for subsequent mailing to Chapters. Other aids to Program Chairmen are also planned.

News gathering, the writing, and editing of *ASTE News*, preparation of promotional material, editing and processing of minutes, bulletins, and form communications are functions of Public Relations. Trade papers, house organs, and the daily press are studied for items of interest to the Society or for possible development into editorial matter for *The Tool Engineer*.

Reports from Public Relations Chairmen and many of the miscellaneous requests from members and nonmembers are handled in this division.

These changes are in line with the policy of segregating office operations to coincide with National Committee activities.

Nominating Committee Seeks Candidates

Prospective nominees for 1945 National Officers are being considered by the National Nominating Committee, organized during the semi-annual convention.

This committee, which automatically assumes office October 1st, consists of the seven senior Directors in point of membership (as specified in Section B 5-2 of the By-Laws).

L. J. Radermacher, President, Stokerunit Corp., 4548 W. Mitchell, Milwaukee 14, Wisconsin, was chosen Chairman, with Frank W. Curtis, Consulting Engineer, 48 Magnolia Terrace, Springfield 8, Mass., as Recorder.

Thomas P. Orchard, Partner and Gen. Mgr., American Tool Engineering Company, 1775 Broadway, New York City 19; and A. M. Schmit, Mgr., A. M. Schmit Company, 643 Sylvania Ave., Toledo 12, Ohio, are also holdovers from last year's committee.

The remaining three members are recently-elected Directors Kenneth C. Jasper, Methods Engineer, Westinghouse Electric & Mfg. Company, Box 1860, Louisville 8, Ky.; (A news story concerning Director Jasper appears elsewhere in this issue.) Arthur J. Denis, Chief Tool Engineer, Carbide Tool Mfg. Company, 8689 Melrose Ave., Los Angeles 46, California.; and W. A. Dawson, Chief Master Mechanic, DeHavilland Aircraft of Canada, Ltd., Hamilton, Ontario.

Mr. Denis became affiliated with the Society and Detroit Chapter in 1934, transferring in 1941 to Los Angeles where he has served as Publicity, Editorial, Education and Training Chairman, and Chapter Chairman.

When he joined ASTE in 1940, Mr. Dawson was assigned to Toronto Chapter, subsequently becoming the first Chairman of Hamilton Chapter during 1941-42. Since that time he has been Canadian Area Vice Chairman of the National Editorial Committee.

Names of suggested nominees for President, Vice Presidents, Secretary, and Treasurer may be forwarded to any of the foregoing at the addresses indicated. The completed slate will be submitted to the Board, for voting, at its Annual Meeting in March.

L. J. Radermacher, Chairman

A. M. Schmit

Frank W. Curtis Recorder

T. P. Orchard

K. C. Jasper

W. A. Dawson

A. J. Denis

Associations Honor ASTE'ers

In recent elections of two organizations affiliated with the metal-working industry, several national offices were captured by members of this Society.

At the annual meeting of the National Machine Tool Builders Association, held at Hot Springs, Va., the three top honors went to ASTE'ers. Joseph L. Trecker, Executive Vice President of Kearney & Trecker, heads the group as President, William P. Kirk, Vice President, Pratt and Whitney Div., Niles-Bement-Pond Co., West Hartford, Conn., was elected First Vice President, with Herbert H. Pease, President, New Britain-Gridley Machine Div., New Britain Machine Co., New Britain, Conn., as Second Vice President.

Mr. Trecker is a member of Milwaukee Chapter, ASTE, while Messrs. Kirk and Pease are both affiliated with Hartford Chapter, the home of two of our Past Presidents. Mr. Pease also became a director along with A. M. Johnson, President, Barnes Drill Co., Rockford, Ill., and a member of Rockford Chapter.

The National Tool and Die Manufacturers Association, which convened at Cleveland, chose Willis G. Ehrhardt, President, Ehrhardt Tool & Machine Co., St. Louis, for Vice President, and Ben Buerk, President, Buerk Tool Works, Buffalo, as Secretary.

Mr. Ehrhardt and Mr. Buerk are both members of the ASTE Chapters in their respective communities.

ASME Schedules '45 National Meetings

New York—The American Society of Mechanical Engineers has made the following preliminary announcement of conventions planned for 1945: Spring Meeting—Hotel Statler, Boston, Mass., April 16-18; Semi-Annual Meeting—Hotel Stevens, Chicago, Ill., June 18-20.

Further information may be secured from Ernest Hartford, Executive Assistant Secretary, ASME, 29 W. 39th St., New York 18.

Frozen Sponge Rubber Drilled Accurately

Worcester, Mass.—Holes drilled in sponge rubber, while it is frozen, will check to .0001 inch accuracy when it has thawed, according to Frederick W. Whitcomb, Deep Freeze Division, Motor Products Corp., Chicago, who spoke at the January 9th meeting of Chapter 25, at Putnam & Thurston's

In his talk on "Deepfreeze," Mr. Whitcomb also pointed out that parts that have been through this process will machine with a better finish, that lowering the temperature from plus 212°F. to minus 120°F., three times, seasons cast iron as well as five or six years of outdoor ageing.

A sound film on AC welding was also shown through the courtesy of General Electric Company.

Among visitors present were Rudolph A. Johnson, Chairman, Society for Metals, who invited the Chapter to join with his group March 14th, and Director William W. Young who extended an invitation to Boston Chapter's Executives Night, March 8th.

Tells Milling Principles And Practices

Syracuse, N. Y.—"Milling and Milling Principles" formed the subject of a lecture given by Charles B. DeVlieg, President, DeVlieg Machine Company, Detroit, before 110 members of Chapter 19 when it met January 9th at the Onondaga Hotel.

Well-Known Educator Discusses Training

Newark, N. J.—An outstanding program devoted to engineering education was presented by Chapter 14, December 12 at Hotel Robert Treat.

Dr. John J. Caton

Dr. John J. Caton, Retired Director of Chrysler Institute of Engineering, Detroit, gave his well-known address, "Common Sense In Education," which held the audience spellbound. His several lectures on the subject of industrial training have been heard by engineering students, scientific societies, and other groups throughout the country.

Listed in "Who's Who in America," "Who's Who In Engineering Education," and "Who's Who In The World," Dr. Caton is one of the Society's three Honorary Members.

Newest Chapter Host To Director

Richmond, Ind.—Director Hayden R. Shearer paid an official visit to this Chapter when it met January 9th at the Leland Hotel.

Mr. Shearer, Chief Gage Designer, Allison Engineering Division, G.M.C., Indianapolis, gave an inspirational talk, complimenting the young group on the progress they have made in their three months of existence.

The technical session, "Shop Measurements To Millionths of an Inch by Light Waves," was conducted by ASTE'er Adam Gabriel, Vice President of the Acme Industrial Company, Chicago. He outlined the tedious work of Prof. Michelson who established the number of light waves contained in the standard meter, using slides to illustrate his excellent lecture.

The screening of the TWA film, "Winged Horizons," completed an outstanding program enjoyed by the 112 engineers in attendance.

Director Shearer Congratulates Richmond Group

Left to Right: 1st Vice Chairman R. E. Lockridge, Jesse Johnson, Secretary E. S. Kinnear, Regional Director H. R. Shearer, Mr. Rogers, Chairman Don B. Showalter, and J. R. Robertson.

Technical Co-Operation Boosts War Production

Detroit, Mich.—In 1944, while American forces blasted their way into France, Germany and the Philippines, the automotive industry established a new all-time high war production record by turning out $9,320,000,000 worth of armament during the year, or more than $1,000,000 worth every hour.

This was announced by George Romney, Managing Director, Automotive Council for War Production, which recently marked its third anniversary.

The total value of automotive war production this year was approximately eight per cent over that of last year, bringing the grand total produced since Pearl Harbor in former automotive plants to $23,000,000,000, with orders on hand amounting to $11,000,000,000 to be filled in 1945.

The industry also produced approximately $700,000,000 worth of parts to keep civilian cars and trucks running. Thus, the total value of its output for the year was in excess of $10,000,000,000, or more than twice the value of civilian products it turned out in 1941, its peak peacetime year.

"This vast output results from the application of individual skills and resources developed during peacetime to the gigantic task of production in competition with our country's enemies," Mr. Romney pointed out. "In the war program, more than 500 automotive manufacturers in 31 states, who were competitors before Pearl Harbor, worked as a production team, exchanging technical data and co-operating to overcome production bottlenecks."

He also stated that contract prices of war equipment produced by the automotive industry, exclusive of transport vehicles, have decreased approximately one-third since January 1, 1942, according to computations from price indexes compiled by the War and Navy Departments. This decline, he said, does not take into account additional savings to the government resulting from lump sum refunds or from renegotiations by price adjustment boards. Among the greatest price reductions is the item of guns of all types, down 56 per cent, with small arms including machine guns down 64 per cent.

"These price reductions are due mainly to the application of the industry's mass production methods and advanced manufacturing techniques to the military products," Mr. Romney concluded.

Largest unfilled orders are for aircraft and aircraft parts, including engines and propellers. Next in line, are orders for military vehicles, tanks, marine equipment, guns, ammunition and sundries. In addition, the industry is working on a program to develop and mass-produce several new types of equipment, including impulse duct engines for robot bombs, and turbine jet engines for an advanced fighter plane now being tested by the Air Corps.

New Duties Assigned

Detroit, Mich.—James R. Weaver, Past President and former Director of the Society, who has been in charge of the U. S. Naval Ordnance Plant at Center Line, operated by the Westinghouse Electric & Mfg. Company, has been appointed Works Manager of the East Springfield (Mass.) Westinghouse plant.

Mr. Weaver will continue in both positions until June 30 when the Navy Department will take over the operation of the Center Line plant, leaving him free to take up his residence at Springfield.

Electronics Authority Speaks

Rochester, N. Y.—Approximately 250 members and guests of Chapter 16 assembled January 10th at Rochester Institute of Technology, the group's new meeting place.

Following the showing of the very enjoyable General Motors film, "America Can Give It," Chairman Chauncey G. Newton introduced F. H. Penny, Installation Engineer, General Electric Company, Schenectady, who spoke on "Electronic Applications To Machine Tools." Mr. Penny, who is recognized as an authority on Electronics, answered many questions.

Visitors included Worcester Chapter Chairman Herman G. Libby and E. H. Bramson, General Railway Signal Company. The latter asked for suggestions concerning the manufacture of a new aircraft ordnance item, receiving a number of solutions from the membership.

The chapter officers and directors reported that interesting letters of acknowledgment have been received from some of the 22 Armed Service members who were remembered at Christmas with gifts from the Chapter.

Dimensional Control Practice Related

Montreal, Que.—Chapter 50 marked its 25th meeting with a technical session on "The Economic Value of Simplified Dimensional Control" January 10th at the Windsor Hotel.

I. A. Hunt

The speaker, I. A. Hunt, Sales Promotion and Advertising Manager, Federal Products Corporation, Providence, Rhode Island, was particularly well qualified through long experience to lecture on the theory and application of dimensional control. Slides and films augmented his talk.

Light Waves Explained

South Bend, Ind.—Isaac Newton's discovery that light waves have a constant wave length was the first step in the development of the modern measuring device using this medium, according to Adam Gabriel, in his address on "Light Waves and Their Uses in Shop Measurements" to the local Chapter, December 12th at the Indiana Club.

Mr. Gabriel, Vice President of the Acme Industrial Company, Chicago, using slides to illustrate his lecture, explained the new instrument which utilizes light wave length as a standard of linear measurement. He described in detail the light wedge as employed for comparative measurement by the reflections of a monochromatic light in the optical flat, giving some practical examples in securing extreme accuracy through light wave measurement.

The 49 members and guests engaged the speaker in a lively discussion at the conclusion of his talk.

Airline Head Speaks At "Executives Night"

Chicago, Ill. — "Air Transportation in The Post War Period" was the subject of an address by W. A. Patterson, President of United Air Lines, at the first Executives Night dinner held by

Left—W. A. Patterson; right—J. Rudolph Miller, Chicago Chapter Chairman and Works Manager, Link-Belt Ordnance Co.

Chapter 5 in the main ball room of Hotel Sherman, January 5.

About 600 ASTE members and guests attended this outstanding meeting. At the speakers table were seated a number of industrial executives of metropolitan Chicago, officers of the local Chapter, and ASTE National President D. D. Burnside, Second Vice President A. M. Sargent, and Executive Secretary Adrian L. Potter.

Mr. Patterson said that Air Transport would not replace all other forms of transportion. It has not been found a practical means of moving armies, but is used as a specialized transportation for specialized personnel; neither is it advantageous to consume large quantities of fuel to transport relatively low tonnages of freight by air, he indicated. Properly-regulated competition between all types of carriers will result in the greatest benefit to the public, the speaker stated.

Surface Measuring Demonstrated

Indianapolis, Ind.—Ernest J. Abbott of Physicists Research Company, Ann Arbor, Michigan, described "The Displacement Recorder" to Chapter 37 at their January 4th meeting in Hotel Lincoln.

He outlined the history of the development of surface measuring and surface recording machines, illustrating his subject with slides.

A demonstration followed of a surface recording machine measuring the surface roughness of a large shell.

Board Votes For Detroit Meeting

Detroit, Mich.—By unanimous vote, the Board of Directors have agreed to rescind the action taken at their 1944 Annual Meeting in Philadelphia, designating Cleveland as the site of their Spring meeting, in favor of a session to be held at Detroit, March 23-24.

This decision followed their earlier action postponing indefinitely the proposed Exposition and Annual Meeting of the Society to run concurrently at Cleveland, March 19-23.

Tooling Problems Aired At Grinding Session

Toronto, Ont.—A well-planned program devoted to grinding problems was presented by Toronto Chapter January 8th when Allen E. Stubbs of Bryant Chucking Grinder Company, Springfield, Vermont, gave a short talk on "Better Tooling for Internal Grinding," setting forth the information required by a machine tool manufacturer before he can give maximum results in internal grinding equipment.

The importance of complete, current specifications and good part prints was emphasized. He was assisted by L. C. Gilchrist of the company's Detroit office.

Mr. Stubbs illustrated his lecture with a technicolor film, "Internal Grinding," which was enthusiastically received. The picture covered both the tool room and production requirements, clearly depicting the highly-vital question of grinder tooling.

A spirited question period brought to light a number of new problems. Keen interest was exhibited in the development of high speed internal grinding equipment, eventually capable of reaching 100,000 r.p.m., and finishes of the order of one half of one micro inches.

The screening of a technicolor film, "Guns For Victory," preceded the technical session. The motion pictures, sponsored by Atlas Steels, Ltd., Welland, disclosed the fabrication of gun barrels from crude to finished form.

Among the 125 members and guests in attendance were Regional Director W. A. Dawson who is Chairman of Hamilton Chapter, E. W. Scheel of Rockford Chapter, and Harold Porter of the Windsor group.

"Nutmeggers" Make Merry

New Haven, Conn.—Business and pleasure were happily combined at George & Harry's Restaurant where 74 members and guests of Chapter 41 enjoyed a turkey dinner December 14th.

Attendance increased to 90 with the opening of the technical program, featuring Leslie F. Airth, Manager, Do-All Hartford Company of that city, who presented an instructive slide-film talk on the use and care of gages and gage blocks. After an extended discussion period, Mr. Airth demonstrated a complete selection of gages.

Entertainment by an adept magician preceded Santa Claus' appearance and distribution of gifts to all present.

Invasions Narrated By Naval Officer

Baltimore, Md.—Vividly describing the work of the Navy in the great invasion thrusts at Normandy, Southern France, Sicily, and Italy, Lt. John C. Cocks, U.S.N.R., Baltimore Port Director's Office, kept his audience keenly interested when he addressed Chapter 13 January 3d at the Engineers Club.

Lt. Cocks used as his subject "Sidelights on the Work of the Navy at War" which was highlighted by an account of the landing operations at Saipan and other points in the Pacific.

Divides Inch Into Millionths

Columbus, Ohio—How measurements, accurate to a millionth of an inch, are possible was made evident to Chapter 36 by C. C. Hartwig, Engineer, Do-All Cincinnati Company, the speaker at their Fort Hayes Hotel meeting January 10th.

"Dimensional Quality of Gauge Control," Mr. Hartwig's topic, was illustrated with a sound film, "Scientific Precision Accuracy With Gage Blocks and Gage Instruments." A mobile unit, containing gage blocks, gage instruments, comparators and optical flats showing how millionths of an inch are measured, was demonstrated.

Heat Treatment Analyzed

Los Angeles, Calif.—"Heat Treatment of Various Types of Tool Steel" was the subject presented by J. R. Harbaugh, Metallurgist, Jessop Steel Company, to the 188 members and guests attending the January 11th Chapter 27 meeting at Scully's Cafe.

Los Angeles Chairman Dick Linch (left) thanks J. R. Harbaugh for his talk on Heat Treating.

Mr. Harbaugh stressed the causes of failure of tool steels, particularly in hardening and grinding.

To complete the program, several reels of motion pictures on "The Making and Shaping of Steel" were presented through the courtesy of the U. S. Steel Corporation. The production showed the manufacture of steel from mine to finished product.

Balancing Machine Paper Read

Racine, Wis.—Use of modern appliances and equipment incorporating rotating elements can lead to nervous strain and fatigue, if the rotating elements are not properly balanced thereby producing vibration and noise, Chapter 2 was told by Werner I. Senger, Manager and Chief Development Engineer of the Balancing Machine Division of Gisholt Machine Company, and speaker at their January 8th meeting held at the Manufacturer's Association.

Mr. Senger pointed out that the trend toward higher speeds makes accurate balancing essential in order to eliminate vibration. Slides depicted the various machines capable of balancing parts weighing from a fraction of a pound to several tons.

Dinner And Dance Dedicated To Ladies

Binghamton, N. Y. — Waiving their regular busines meeting, the local Tool Engineers played host to their ladies with a dinner and dance in the Spanish Ballroom of Hotel Arlington, December 8th.

Dr. Christenberry A. Ritchie offered the invocation before the three hundred and fifty members and guests sat down to a fine roast turkey dinner. A program was presented by the I.B.M. orchestra and the Co-Ba-Co quartet.

E. W. Barnes was General Chairman of the very enjoyable function, and Chairman R. L. Barratt acted as Toastmaster. Dancing concluded the program.

On January 3rd the Chapter met at Hotel Sherwood to hear Mr. Wayne Trees, Service Department Manager, Scintilla Magneto Division of Bendix Aviation, speak on the "Importance of Service Tools in Aircraft." Mr. Trees, a very capable speaker, illustrated his talk with motion pictures. He was assisted by Mr. Arthur Elliott, one of his field representatives.

Precision Casting New Topic

Springfield, Mass. — Another of Chapter 32's successful programs, recognizing local industries, was presented January 8th at Hotel Highland, when "Worthington Pump & Machinery Corporation Night" was featured with Roy F. Kingsley of that company acting as technical chairman.

Mr. Kingsley presented B. L. Levison of B. F. Hirsh, Incorporated, New York City, who spoke on "Precision Casting," a new and timely subject. The audience was much impressed with the accuracy obtainable with this type of casting.

The development and construction of the 90 mm. gun mount as manufactured by the Worthington Company were also shown in motion pictures.

Superintendent of Schools Charles Mitchell of Easthampton paid the Chapter a return visit, with an interesting coffee talk on "India, China and Japan." Mr. Mitchell, long a resident of the Orient, is well-informed on this subject.

Damaged Tools Reclaimable

Washington, D. C. — Unique examples of new and usable tools constructed through salvage of worn and broken ones were quoted by Arthur A. Merry, Chief Tool Designer, Pratt & Whitney Aircraft, East Hartford, Conn., at the Hotel 2400 meeting of Chapter 48 held January 4th.

Arthur A. Merry

Mr. Merry in his timely address, explained the use of carbide tipping for reclamation of obsolete tools, graphically illustrating his talk with slides.

The technical speaker was followed by films entitled "Welcome to Britain" and "Target Victory."

New Year Brings Promotion To Two

Peoria, Ill. — Recent personnel changes at Caterpillar Tractor Company resulted in new positions for two members of Chapter 31.

Charles A. Woodley, formerly Factory Manager, has been promoted to Assistant General Factory Manager. He has been connected with this company since 1926, beginning as a four-year machinist apprentice and advancing successively to the Tool Room and Planning Dept., Machine Shop Foreman, Superintendent of Industrial Engines, Assistant Factory Manager, and Factory Manager, the post he now relinquishes.

General Factory Manager James R. Munro, also an ASTE'er, appointed

William L. Naumann

Charles A. Woodley

William L. Naumann Factory Manager to succeed Mr. Woodley.

Mr. Naumann entered Caterpillar's employ in 1929 as a four-year machinist apprentice, graduating to the Inspection Department as a Gear Technician, later becoming supervisor. In 1941 he was made a superintendent in the Machine Shop and advanced to Assistant Factory Manager, maintaining that position until his present assignment.

SAE and ASTE Have Joint Session

Dayton, Ohio—Large groups from the SAE and ASTE attended the dinner meeting and technical session, sponsored jointly by the two organizations, at the Engineers Club January 8th.

SAE's program contribution was a non-technical paper, "The Advantages and Disadvantages of Diesel Motors For Highway Transportation," by F. B. Lautzenhiser, Consulting Engineer for International Harvester Company.

"High Speed Carbide Milling" by Howard L. Pope was ASTE's presentation, followed by motion pictures taken at 3,000 frames per second and screened at slowed speed to show the action occurring. Mr. Pope heads the Engineering Service Department at Cincinnati Milling and Grinding Machines, Inc.

* * *

The ballroom of the Van Cleve Hotel was taxed to capacity by the 110 couples who gathered for an evening of fun at Chapter 18's Christmas Party. An elaborate dinner preceded the splendid entertainment and dancing which continued till the "wee-hours."

Among out-of-town guests were Former Director and Mrs. J. W. Frederick and Mr. and Mrs. Albert B. Schlattner of Cincinnati.

Finger-Print Thickness Measurable

Louisville, Ky.—An assertion that, with modern instruments, the 5 to 8 millionths of an inch thickness of a finger-print impressed on metal could be measured was one of the highlights of the lecture on "Precision Inspection" given by Louis Lingler of the Educational Department of the Sheffield Corporation, Dayton, before this Chapter January 9th.

Dinner at the Kentucky Hotel preceded Mr. Lingler's address to an audience of approximately 150. His talk, based on the use of modern gaging instruments at production machines, for improved process control, was illustrated with slides and demonstrations. He also quoted a high-ranking Ordnance Officer to the effect that one ten thousands of an inch tolerance, as applied to the fabrication of certain vital Ordnance parts, means more than a hundred mile advance of an army.

A rising vote of thanks was tendered the speaker for his fine presentation.

Former Chairmen Honored

Grand Rapids, Mich.—The Christmas season was appropriately chosen for recognition of Past Chairmen Joseph Monahan, Elmer J. Roosien and George H. Hoogerhyde at the December 11th meeting of Western Michigan Chapter in Park Congregational Church.

Each of the former Chapter heads was called upon for a few words and then presented with a diamond Past Chairman's Pin.

The speaker of the evening, Elton Miottel, Engineer, George Gorton Machine Company, Racine, Wisconsin, using as his subject, "An Exact Duplicate," gave a brief talk on the applications of tracer-controlled machines. Mr. Miattel illustrated his talk with a sound, color film showing newest techniques in tracer-controlled milling, duplicating and engraving.

Forty members and guests were in attendance.

Shows Wartime Uses Of Honing

Cincinnati, Ohio.—Honing, its origin, history and present applications in modern, mass production as presented by John W. Kinsey, Field Engineer, Micromatic Hone Corporation, Detroit, headed the technical session held by Chapter 21 at the Engineering Society Heaquarters Building January 9th.

John W. Kinsey

After a brief review of the background of honing, Mr. Kinsey showed "More Than Machines," a film exemplifying the importance of hone finishes in war materiel, and "Hone Abrading Process" which depicted visually the advantages of both external and internal honing. An assortment of honed pieces was on display.

Broaching And Powdered Metal Programmed

Hamilton, Ont.—An excellent address on "Modern Broaching Methods" by Harry H. Gotberg, Chief Engineer, Colonial Broach Company, Detroit, drew an attendance of approximately 75 members of Chapter 42 to Kirby House, Brantford, January 12, in spite of cold weather, bad roads, and pressure of business.

Mr. Gotberg, a popular Chapter speaker, covered the design, application, use and care of broaching tools in his talk which was followed by colored films illustrating the highlights.

* * *

"Manufacturing Methods and Uses of Powdered Metal Bearings and Machine Parts," the subject of the December 8th meeting held at the Royal Connaught Hotel, of this city, was well presented by A. J. Langhammer, President of Amplex Division, Chrysler Corporation, Detroit.

The speaker made it clear that the scope of the tool and production engineer can be broadened through the application of powdered metallurgy to the manufacture of machine parts, eliminating numerous machining operations, saving man hours and the ultimate costs of parts.

New Pantographing Techniques Told

New York City—The latest duplicating operations employed on the pantograph engraving machine, as well as examples of multiple etching, were illustrated in technicolor for Chapter 34 when it met January 9 at the Hotel New Yorker to hear Mr. Elton Miottel, Customer Research Engineer, George Gorton Machine Co., Racine, Wisc.

Mr. Miottel's remarks prefaced the showing of his film, "An Exact Duplicate," which described interesting applications of pantographing including a new method precision grinding of irregular shapes, at air spindle speeds up to 75,000 r.p.m., and production profiling of parts which must be held to close tolerances.

Ladies Entertained At Monte Carlo Party

Cleveland, Ohio—Huge sums—in stage money—changed hands among Chapter 3 and their guests at the Monte Carlo Party on "Ladies Night" January 13th at the Hotel Hollenden.

The gala evening began with dinner, continued with roulette and concluded with dancing.

Newest Broaching Methods Heard

Detroit, Mich.—Members of the Motor City group met at the Horace H. Rackham Memorial Building January 11th to hear Arthur A. Cambria, Chief Design Engineer, LaPointe Machine Tool Company, Hudson, Massachusetts, discuss the "Why, What, and How of Broaching." In his talk, Mr. Cambria described recent developments in broaching machines, the automatic propeller hub, splining and rifling machines.

As an added feature, a non-technical colored film was shown.

Powder Metallurgy Opens '45 Program

Pittsburgh, Pa.—Chapter 8 listened to an informative talk on machine parts made from powdered metals when George E. Platzer, Chief Engineer, Amplex Division, Chrysler Corporation, Detroit, addressed the 106 members attending the January 5th meeting.

Mr. Platzer, in his talk, revealed up-to-the-minute knowledge of the principal applications in compressing powders into metal parts, of interest to all Tool Engineers.

Members and guests numbering 600 attended the annual Christmas Party at the Fort Pitt Hotel, December 22nd, which terminated a very active year for Pittsburgh Chapter.

Induction Heating Talk Fascinates

Elmira, N. Y.—Dr. Harry B. Osborn, Jr., Director of Research, Tocco Division, Ohio Crankshaft Company, Cleveland, thrilled those present for Chapter 24's January 8th meeting at the Mark Twain Hotel, with a fascinating discussion of Induction Heating.

Dr. Harry B. Osborn

The first meeting of the year was marked by Chairman George N. Morceau's introduction of new members elected during 1944 and guests from Toledo, Philadelphia, Syracuse, and Worcester Chapters.

Mr. Osborn very ably conveyed to the 106 engineers present the uses of Induction Heating in modern, mass production, including simplification of operations, adaptability to simpler steels, and versatility of applications to many common processes.

"An Exact Duplicate," an excellent technicolor film, showing the newest processes in tracer-controlled milling, duplicating and engraving, was presented by Elton Miottel, Customer Research Engineer, George Gorton Machine Company, Racine, Wisconsin.

New Movie Process Demonstrated

Springfield, Vt.—An unusual program was presented by Twin States Chapter when it met at the Community House January 10th to hear Floyd Ramsdell, President of the Worcester Film Corporation, Worcester, Massachusetts, delineate the making of three dimensional motion pictures and stills.

Mr. Ramsdell not only screened some of his productions, but also demonstrated equipment used in exposing and developing such pictures. The speaker pointed out that the illusion of depth greatly increases the effectiveness of the pictures as a medium of instruction. He outlined the experimental work being done by his company in further developing the use of movies for training purposes in professional fields such as surgery.

A record attendance of approximately 150 members and guests was attracted by this presentation.

Metal Extracted From Sea Water

St. Louis. — "Magnesium—The Metal From the Sea," its extraction, production and uses were set forth by Arthur Smith, Jr., Production Control, Magnesium Division of the local office of Dow Chemical Company, in his presentation to Chapter 17 at the Melbourne Hotel, January 4.

Mr. Smith showed slides and sound films depicting the various stages of magnesium production and applications. After an interesting discussion from the floor, the group inspected a display of the lightweight metal castings, forgings and machinery finishes.

Research, Designing, Gaging Triple-Featured

Kansas City, Mo.—Three excellent speakers were presented to 75 members and guests at Chapter 57's December 6th meeting in the Pickwick Hotel when Chairman A. J. Mirick introduced J. F. Stephens, Vice-President, Gustin-Bacon Manufacturing Company, Jack Koch, Technical Engineer, Carpenter Steel Company, and H. H. Hoover, Pratt and Whitney.

Mr. Stephens, one of the incorporators of the Midwest Research Institute, illustrated with films his outline of development work being done by the Institute.

"Do's and Don't's of Tool Design" was the subject used by Mr. Koch in his talk on balancing designs to facilitate heat treating.

Mr. Hoover's discussion was devoted to gages and gaging practice.

Dinner and Dance Mark Holidays

Buffalo, N. Y.—The third annual Christmas party, held December 23d at the Trap and Field Club, replaced the regular December meeting of Buffalo-Niagara Frontier Chapter.

Approximately 200 members and guests enjoyed the full-course turkey dinner preceding the entertainment.

Gifts were awarded in keeping with the Christmas spirit.

At the January 18th meeting, G. B. Berlien, Lindberg Steel Treating Company, Chicago, discussed "Heat Treating Hints." Paul E. Honhn, Dean, Dept. of Engineering, University of Buffalo, was the coffee speaker.

Cold Treating Methods Told

Peoria, Ill.—Merits of Deepfreeze were discussed by Fred Whitcomb, Sales Promotion Engineer, Deepfreeze Division of Motor Products Corporation, Chicago, at the January 2nd meeting of Chapter 31.

Over 100 members and guests attended the dinner at American Legion Hall, which preceded the technical speaker's excellent presentation. Mr. Whitcomb, who has been instrumental in the design and application of industrial Deepfreeze equipment throughout the country, described the operation of the machine, its uses in the cold treating of metals and in assembly by the shrink process. According to the speaker, stabilizing steel to prevent growth and distortion is an important advantage in cold treating.

Chain Making Methods Shown

Moline, Ill.—Fifty-five members and guests of Tri-Cities Chapter braved the elements January 10—one of the coldest nights of the season—to hear a discussion on the manufacture of various types of chains by F. J. Benjamin, Chicago District Manager of the Columbus-McKinnon Chain Corporation, Tonawanda, New York. Mr. Benjamin illustrated his lecture with motion pictures.

Mr. Frank Ostlin, Superintendent of Veterans Relief Commission of Rock Island County, gave the coffee talk which followed the dinner served by the LeClaire Hotel. He told of the work being done to assist returning veterans of World War II, emphasizing that the families of members of the armed forces are also being given material assistance.

Hub Leader Promoted

Boston, Mass.—Henry J. Richards, Chairman of Chapter 33, and formerly Assistant Superintendent of Inspection at the River Works and Everett Supercharger Plants of the General Electric Company, was recently made Superintendent of Inspection at both plants.

Henry J. Richards

Mr. Richards has been active in Society affairs, having held a number of offices in his Chapter. At the 1942 Semi-Annual Meeting, held in Springfield, Massachusetts, when he was Chief Inspector of the Everett Supercharger Plant, he chairmanned the "Inspection" session.

Powdered Metals Discussed

Hartford, Conn. — One of the Tool Engineer's real opportunities in the post-war period lies in the use of powdered metals, according to George C. Platzer, Chief Engineer, Amplex Division, Chrysler Corporation, Detroit, who discussed "Making Parts From Powdered Metals" at the January 8th technical session held by Chapter 7 in the Hartford Gas Co. Auditorium.

Mr. Platzer proved to be a very effective speaker, explaining concisely and in easily-understood words the fundamentals and many uses to which powdered metallurgy can be applied, adding that the process has now advanced beyond the experimental stages.

An interesting coffee talk was given by Donald F. Fink, Assistant Works Manager, Underwood - Elliot - Fisher Company, at the City Club dinner which preceded the Technical program. Mr. Fink outlined his company's experience in manufacturing carbines for the armed forces.

Approximately 230 members and guests were present.

Fourth Indiana Group Organizes

Muncie, Ind.—Tool Engineers, 112 strong, turned out for dinner Friday, January 5th, at Hotel Roberts, to determine the educational advantages of an ASTE Chapter in that city.

Many months of work, done principally by members William H. Vickers and Earl G. Kelsey of the Tool Design Department, Warner Gear Div., Borg-Warner Corp., culminated in a unanimous decision that such a Chapter is needed and will be helpful to industry and the community, as well as beneficial in helping local tool Engineers to keep abreast of developments in the tool engineering field.

ASTE'er J. D. Rovick served as Toastmaster and, with a few words of praise for the work the Society is doing, introduced Executive Secretary Adrian L. Potter who reviewed the aims and accomplishments of the Society during its twelve years of existence.

Mr. Potter outlined the methods under which Chapters function, the assistance received from the National Headquarters in developing effective educational programs, and emphasized the need for able Chapter officers, adding that the first year of a Chapter's existence is the most critical.

Following a question period those in attendance voted that action should be taken to start a Chapter in Muncie. Representative groups from the many industries each held a caucus and chose a delegate to meet with the Executive Secretary upon adjournment of the meeting. These representatives were as follows:

J. D. Rovick, Michigan Tool Co.; Robert Green, Superior Tool Co.; C. A. Dutton, Warner Machine Products, Inc.; Lester Martin, Broderick Co.; Mel Trayer, Chevrolet Motor Div., GMC, Muncie; Ralph Mangas, Engineering Service Co.; Charles Rothaar, Maxon-Premix Burner Co.; Francis Wilson, Perfect Circle Piston Ring Co., Hagerstown; Hershell Reed, Beckett Bronze Co.; Robert Waters, Durham Mfg. Co.; Paul Grow, Magic City Tool Co.; Berl Kirk, City Tool & Engineering Co.; William J. Brown, Chrysler, Newcastle; J. Rutter, Interstate Machine Tool & Engineering, Inc., Albany; Hill Sharp, J & M; C. C. Crabb, Delaware Machine & Tool Co.; Barclay Reed, Delco-Remy Div., GMC, Plant No. 9; William H. Vickers, Warner Gear Div., Borg-Warner Corp.

This group met again on January 17 to prepare a suggested list of Chapter Officers to be elected when a Charter is presented. At present there are 33 members in Muncie area and it is expected that there will be about 70 before the end of the month.

Arctic Sports Shown

Fort Wayne, Ind. — Chapter 56 was entertained at their January 10th meeting in the Chamber of Commerce Building with a technicolor film entitled "Hunting and Fishing In Alaska." The movies, taken by Reuen Fisher of the Universal Engineering Company, Frankenmuth, Michigan, showed some very fine scenery and real sporting action. Attendance was about 125.

Sales Engineer Made Vice President

St. Louis, Mo.—Clarence L. Miller, Sales Engineer, for 20 years with the Measuregraph Company, manufacturers of cloth measuring machines, screw machine products and special tools, was recently elected a Vice President of the company.

Clarence L. Miller

Mr. Miller, a Past Chairman of Chapter 17, is Mid-West Area Vice Chairman of the National Industrial Relations Committee and Chapter Public Relations Chairman. He served as General Vice Chairman of the 1942 Annual Meeting in this city.

Noted Chemist Makes Return Appearance

Rockford, Ill.—In response to popular demand, Dr. Hilton Ira Jones, Managing Director, Hizone Laboratories, Wilmette, delivered his address, "Vibrations," at the January 4th meeting of this Chapter.

His scientific discourse on the phenomena of electrical, auditory and heat vibrations highlighted the Annual Past Chairman's Night held at Hotel Faust. Dr. Jones, a veteran in the field of chemistry, research and psychology, is a most interesting speaker, explaining these complex matters in a completely comprehensible manner. His earlier talk, "Peeps at Things to Come," heard last year, was also thoroughly enjoyed.

Rounding out an exceptional program, Prof. William V. O'Connell gave an excellent coffee talk on "The Value of an Effective Speaking Personality in Business and Social Life." Prof. O'Connell, Chairman of the Department of Speech at Northern Illinois State Teachers College, DeKalb, did graduate work in the personnel field, and holds membership in many educational fraternities.

Wisconsin Groups Collaborate

Fond du Lac, Wis.—Members and guests of Milwaukee Chapter were royally entertained with plant tours, and a turkey and fish dinner on the occasion of their joint meeting with Chapter 45 at Hotel Retlaw, January 12th.

During the afternoon, the visitors were escorted through the plants of the Sanitary Refrigerator Company, Tobin Tool & Die Company, Wells Mfg. Company, and Giddings & Lewis Machine Tool Company.

The dinner meeting featured a film production, "The Shape Of Things To Come," sponsored by Boonton Moulding Company of Boonton, New Jersey, showing methods of producing plastic parts. A discussion on the art of plastics was conducted by Harry Shaffer and Gus Holmgren, Engineers at Badger Plastics Company, Sheboygan, who also exhibited samples of molded plastic articles.

Induction Heat Expert Talks

Akron, Ohio — "Induction Heat Treatment" was the subject chosen by Chapter 47 for its December 14th meeting at Hotel Mayflower.

The guest speaker, Dr. H. B. Osborn, Jr., Research and Development Engineer, Tocco Division, Ohio Crankshaft Company, Cleveland, outlined the inherent characteristics of induction heating and hardening, including the many applications, methods of control, and advantages, as well as the metallurgy involved, in his instructive talk which was accompanied by slides.

Aesthetic Committee Studies Certificate

Syracuse, N. Y.—Appointment of Otto W. Winter, John A. Lapham, and W. W. Young to act as an Aesthetic Committee, in developing an attractive Membership Certificate from the designs prepared under the direction of the Executive Committee, was announced by President Burnside at the Board Meeting.

American Machinist Photo

Directors Lapham and Young of the Aesthetic Committee examine a design suggested for the proposed Membership Certificate.

As soon as satisfactory text matter and artwork have been evolved, the certificate will be printed and made available to the members, many of whom have requested such a document, suitable for framing, authenticating their membership.

Two Rochesterites Advance

Rochester, N. Y.—Milton L. Roessel, Third Vice-Chairman of Chapter 16 and Central Area Vice Chairman of the Editorial Committee, recently severed his connection as Chief Tool Engineer of the Rochester Production Division, G.M.C., to accept a position with the Folmer-Graflex Corporation as Assistant Superintendent of Production Tools.

Frank Stetzenmeyer, another member of the local Chapter has been promoted to Chief Tool Engineer at the former plant, to succeed Mr. Roessel.

Atlanta Acquires Chapter Plaque

Atlanta, Ga.—A handsome, cast bronze, ASTE plaque, the work and gift of Spurgeon (Spud) Roberts, was presented to this Chapter at a recent meeting. The emblem pattern was made at the Atlantic Steel Company, and the Chapter name plate was designed by the donor.

Mr. Roberts cast the 9" emblem at the foundries of Georgia Tech. After the surface was milled and ground, the natural sand cast finish of

"Thanks, Spud."

Atlanta Chairman Brownell accepts Chapter plaque from Spurgeon Roberts, its designer.

the relief background was painted royal blue. The shield-shaped mount is a single piece of beautifully-grained, burled walnut connected to the name plate by a bronze chain.

Although Chapter 61 is extremely proud of this notable example of the handiwork of one of their members, they have very generously offered to make the pattern available to other Chapters.

Attendance at the meeting broke all previous records, 191 being present for the dinner, with 12 or 15 additional at the technical session.

Arthur Schwartz, Chief Engineer of Tool Research, Bell Aircraft Corp., Buffalo Div., held the undivided attention of the group with his address on "Modern Metal Cutting Methods," emphasizing the fine points in the care, grinding and uses of modern cutting tools.

Distinguished Aviator Guest Speaker

St. Catharines, Ont.—Niagara District Chapter was privileged to hear a pioneer in British aviation, J. A. D. McCurdy, Special Assistant to Financial Advisor, Department of Munitions and Supply, Ottawa, when they assembled at Welland House, December 13.

Mr. McCurdy, who used as his subject, "Canada, Cradle of Empire Aviation," was the first man to fly in the British Empire. He also distinguished himself in the early days of aviation by winning the grand prize in a flight from Florida to Cuba.

An audience of 108 was present for this intensely interesting address.

The PX

HMCS Nanoose
c/o F.M.O. Halifax
Nova Scotia

Dear Sir:

The writer is in receipt of your latest membership card that you so graciously forwarded to me, and wishes to thank you very much for same.

We, of the armed services, are indeed sorry that so many of us are unable to attend the various meetings, but look forward to the day when hostilities cease and we will once more be out in full force amongst real fellows, enjoying the many lectures that only the ASTE can produce.

It is with the most sincere thought in my mind that I say thank you once again for the many privileges accorded me whilst in the Navy.

Yours truly,
Dillon Southwick
Hamilton Chapter.

Headquarters
745th Engineer Heavy Shop Co.
APO 928, c/o Postmaster
San Francisco, California

Gentlemen:

My appreciation and thanks for the excellent service in receiving the "Tool Engineer" and other communications. All the tool hints and short cuts help us considerably in our job of running a 4th and 5th Echelon Maintenance Shop way down here in New Guinea.

Being Manufacturing Officer, I find great pride in being able to pass on to my men what the post war program holds in store for them and how to prepare themselves for it.

Living here becomes pretty rugged at times, but with everybody pitching in the morale is 100%, and everything points to a rapid defeat of the little yellow man.

Here's hoping for greater success to ASTE, and may it not be too long before I can return and enter into all its activities again.

Yours very truly,
Lawrence Longden,
2d Lt., Corps of Engineers,
Detroit Chapter.

Indiana Officers Make New Connections

Indianapolis, Ind.—Harry L. Boese, First Vice-Chairman, Chapter 37, has become associated with Merz Engineering Company as Factory Works Manager. He was formerly employed at the Naval Ordnance Plant.

John Horton is now Plant Manager of the L. G. S. Spring Clutch Corporation, Division of Curtiss-Wright. Mr. Horton, Industrial Relations Chairman of the local group, has been connected with Lukas-Harold Corporation in the capacity of Production Manager.

Chapter News Wanted

Public Relations Chairmen of Chapters—send us *promptly* any news of your Chapter. See article on Page 65.

War Needs Outlined By WPB Official

Washington, D. C.—The status of critical war production programs was reported to Potomac Chapter, at its Annual Executives Night, December 7, in the Mayflower Hotel, by Hiland G. Batcheller, Chief of Operations, WPB.

Mr. Batcheller, who was accompanied by Lt. Col. J. W. Naylor, a much-decorated war veteran, summarized the reasons for the development of new scarcities, with the changing aspects of the war. Supplies of ammunition, machine tools for producing it, heavy trucks and tires he listed as currently acute.

While WPB has no objection to post-war planning, provided it does

Standing, Hiland G. Batcheller Seated, ASTE Vice President C. V. Briner.

not divert manpower from the manufacture of war materiel, he emphasized that reconversion must not interfere with the war effort.

C. V. Briner, First Vice President, served as Toastmaster, and presented a review of Society activities during the past two years. The National Executive Committee, in Washington for their monthly meeting, also attended the Chapter affair.

Many government agencies were represented among the several hundred members and guests present.

Discuss Broaching And Grinding Wheels

Toledo, Ohio—Chapter 9 presented a double-header program, including a coffee talk by one of their own members, when they met at the Toledo Yacht Club January 10.

ASTE'er Robert H. (Joe) Cannon used blackboard sketches to illustrate nis talk on "The New Standardized Grinding Wheel Markings."

The technical session, "History, Value and Technique of Broaching, Used Today in Mass Production of Armament," was conducted by Arthur A. Cambria, Chief Design Engineer, La Pointe Machine Tool Company, Hudson, Massachusetts. Mr. Cambria has been responsible for the development of many new broaching machines which have made phenomenal records in manufacturing guns and gun parts.

Veterans Voted Dues Waiver

Detroit—Suspension of dues payments, for three months after discharge from the Armed Forces of the United Nations, and pro rating of dues for the remainder of that year were granted to members engaged in military service, by vote of the National Executive Committee at its November 11-12 meeting here.

Through earlier legislation, such members have been relieved of dues obligations for the period between induction and mustering-out.

The most recent action reads officially:

VOTED: That Armed Force members shall be relieved of payment of all dues during periods of armed service and for a period of three months after each is discharged or placed on inactive status, at which time his dues for the balance of that fiscal year shall be payable on the basis of one-twelfth ($\frac{1}{12}$) of the annual dues fee for each remaining month of that year. Any dues delinquency prior to induction, enlistment or commissioning shall be forgiven in toto.

Hartford Roster Merits Mention

Hartford Chapter has distributed to its membership another excellent annual program and directory.

This seventh, consecutive, non-commercial, pocket-size publication has an attractive format, contains listings of local and national officials, meeting data for the 1944-45 season, as well as an alphabetical roll of Chapter members and their business affiliations.

Chapter 7 is notable for the good taste evidenced in all its printing.

Obituaries

Word was recently received from Dayton Chapter of the sudden death of Frank J. Wilhelm, Membership Chairman and a very active, aggressive worker for the Society. Mr. Wilhelm, who would have reached his 55th birthday on January 21st, was owner and manager of Wilhelm Engineering Service. His earlier industrial experience, which was wide and varied, included service with a number of Ohio companies.

* * *

Gustave Lundgren of Hardinge Brothers, Inc., Elmira, New York, died on December 31, 1944, at the age of 55. Mr. Lundgren, a member of Elmira Chapter, was born in Westros, Sweden, and came to the United States when he was twenty.

His entire lifetime was devoted to the mechanical industry, having worked for the American Tobacco Machine Company, the International Linotype Company, Bausch and Lomb, The Eclipse Machine Company, and the Morrow Company before becoming associated with the Hardinge organization as an inspector in July of 1933. At the time of his death, he was Chief Inspector.

Carbide Tool Care Stressed

Springfield, Ill.—The importance of properly mounting, conditioning, and sharpening carbide tools was pointed out by E. T. Larson, Sales Engineer, Norton Company, Worcester, Massachusetts, in his illustrated lecture before Chapter 64, January 9, at the Leland Hotel.

The film supplementing his talk, "Grinding Carbide Tools," emphasized the significance of refined surface finish on the cutting edge of carbide tools, and included an explanation of the new marking system which is being sought as a standard among all manufacturers of grinding wheels.

Southern Director Commissioned

Louisville, Ky.—The organization of a State Militia Air Force was officially inaugurated when Governor Willis appointed Kenneth C. Jasper a lieutenant colonel, assigned to Adjutant Gen. G. H. May's staff as air officer. Lt. Col. Robert J. Meyer, aide to the adjutant general, presented the commission.

Colonel Jasper, who is Director of Region 16, ASTE, and Methods Engineer at the Louisville Westinghouse

Louisville Courier-Journal Photo

"Congratulations, Colonel"

Kenneth C. Jasper (Left) receives commission as lieutenant colonel from Lt. Col. Robert J. Meyer (right) aide to the adjutant general.

plant, is undertaking the formation of an air force of six or eight squadrons attached to flying fields throughout Kentucky.

Before coming to Louisville, he served in the Illinois National Guard; also as Secretary and Treasurer of the Society's Tri-Cities Chapter. In addition to his new post, which is uncompensated except during active duty, he is active as Wing Training officer, CAP; a member of the National Aeronautical Association, American Radio Relay League, and the American Arbitration Association.

Director Jasper, the organizer of Louisville Chapter and its first Chairman, attended the Board Meeting at Syracuse, in uniform.

BOOK BRIEFS

Precision Measurement in the Metal Working Industry, Vol. I.—Prepared by the Department of Education of International Business Machines Corp., for training workers, this manual of precision measurement and inspection methods in metal working has been widely used as a textbook in government, technical, and vocational schools.

Chapter headings include, Introduction, Non-Precision Line-Graduated Measuring Instruments, Micrometer and Vernier Type Instruments, Precision Gage Blocks, Fixed Gages, Thread Gages, Dial Gages and Test Indicators. The new 264-page, cloth-bound edition is illustrated with more than 250 photographs, drawings, and diagrams. Price $2.85, postpaid.

Volume II will treat the more advanced types of measuring instruments. Published by Syracuse University Press, 900 University Bldg., Syracuse 2, N.Y.

* * *

Public Speaking Manual—Prepared especially for business and professional men who find it necessary to speak in public or conduct meetings occasionally, this 20-page mimeographed book presents many helpful suggestions for putting across a successful speech. There are chapters on Introductions, Modern Style, Stage Fright—Its Cure, Platform Appearance, The Audience, Rules for Good Delivery, Introductions and the Toastmaster, Preparations, Public Speaking Tips, and Use of Humor. Price—$1.50 per copy, from the National Reference Library, 2014 Turbenson, Cleveland, Ohio. This service also has a list of prepared talks and programs available, covering many subjects and occasions.

* * *

Screw Threads of Truncated Whitworth Form—A system of threads of truncated Whitworth form developed by Army Ordnance has made possible interchangeability with components having full-form British Standard Whitworth Threads, facilitating the production of war materiel in America, for British countries.

The new ASA, approved, American War Standard, B 1.6-1944, includes specifications and gaging instructions, covering various types of threads. Price, 50c per copy from American Standards Association, 70 E. 45th St., New York 17, N. Y.

* * *

Shot Peening and the Fatigue of Metals—The increased life imparted to stressed materials by subjecting the surface of a metal machine part to a rain of metallic shot is ably treated in text, charts, and illustrations, as interpreted by H. F. Moore, Professor of Engineering Materials at the University of Illinois.

Professor Moore is renowned in the engineering profession for his research on the fatigue of metals. His studies on shot peening, which form the basis for this analysis, were pursued through many months of research and testing.

Copies are available upon application to the publishers, American Foundry Equipment Company, Mishawaka, Indiana.

WHAT'S YOUR CLAIM TO FAME?

Are you a magician?

Who is a soloist—vocal—instrumental—terpsichorean?

Is there a quartet in the Chapter?

Can someone give a good chalk talk?

What Chapter has an orchestra?

Who's the ASTE monologuist or black-faced comedian?

Is your fellow member an impersonator or an Edgar Bergen?

Maybe you have a local Bob Hope or Abbott and Costello team?

If so, we want to know about this hidden entertainment talent that might be made available for enjoyment at Society Meetings.

Here's an opportunity to put your Chapter in the limelight. Fill in and return to Headquarters the coupon below, describing good parlor tricks performed by your Chapter members.

American Society of Tool Engineers

1666 Penobscot Building — Chapter_____

Detroit 26, Michigan — Date_____

Yes, our Chapter has some good entertainers. We can recommend the following: (*List performers, and describe acts. Use another sheet if necessary.*)

Signed_____

(*If Chapter Officer, include title*)

FILM FLASHES

"How to Form Aluminum" Series:

* *General Sheet Metal Practice* illustrates methods employed in bending, hammering, beading, flanging, edging, and otherwise forming aluminum sheet. Determination of the proper bend radii for different aluminum alloys, the problem of springback and compensation, and the proper care of tools are all described. Running time, 20 minutes.

* * *

* *Blanking and Piercing* depicts techniques employed in cutting blanks and piercing holes in aluminum sheet. Laying sheet out economically, designing tools with proper clearance, precautions in setting up tools, lubrication and maintenance, use of shears, saws and routers, and the Guerin "rubber pad" method are explained. Running time, 15 minutes.

* * *

* *Drawing, Stretching, and Stamping* discusses the forming of cylindrical, rectangular and odd-shaped parts of aluminum in single and double-action presses. Emphasis is placed on the alloys best suited for drawing and stretching, and how the choice of alloy influences tool design, clearances, radii, and reduction per draw. Running time, 22 minutes.

* * *

* *Spinning* outlines three methods—hand-spinning, partially-mechanical, and entirely-mechanical. Tools used for various operations, alloys most suitable, and the use of chucks are included. Running time, 16 minutes.

These, and earlier sound productions of the Aluminum Company of America, may be borrowed in 16 or 35mm. sizes from the Motion Picture Dept., at 801 Gulf Bldg., Pittsburgh 19, Pa., or local offices.

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* *Tooling for Better Internal Grinding* covers problems encountered in the tool room and in mass production. It shows the importance of universal tooling for small lot production, standard tooling adapted to production work, special tooling combining several operations in one checking, and plunge and traverse methods of irregular contour grinding.

The new, 16mm., 40-minute sound film is available from Bryant Chucking Grinder Co., Springfield, Vt.

* Literature available from National Headquarters, ASTE.

Need a Projector?

One Movie-Mite 16 mm., sound-on-film projector is still available at cost from National Headquarters.

Several Chapters are enjoying these compact, portable units which the Society purchased before such equipment became high-priority goods.

The machine is a model of simplicity and tool engineering ingenuity, holds 1600-ft. reels, and weighs but twenty-four and one-half pounds, complete with screen and speaker.

Descriptive literature and price may be had from the National Office.

Better Membership Applications Result From Nine-Point Guide

Worcester, Mass.—In order to facilitate the prompt processing of applications, National Membership Chairman V. H. Ericson has issued to key officers in each Chapter a Nine-Point Guide for submitting membership applications.

Since a prospect's acceptance or rejection may hinge upon the degree of care exercised in filling in his application, it is important that Chapter officers scrutinize these forms for completeness before forwarding them to Headquarters for grading by the National Membership Committee.

In his enumerated instructions, Mr. Ericson says:

*1. **Initiation Fee and One Full Year's Dues** should be submitted with application.*

*2. **Date of Birth** is important. To be a Senior member, the applicant must be at least twenty-five years of age.*

V. H. Ericson

*3. **Technical Education and Degrees** should be listed. Some credit is given for this, particularly in determining the date of upgrading from Junior to Senior.*

*4. **Seven References Should Be Listed,** at least five of whom should be members of ASTE. These should be checked by the Chapter Committee when the applicant is not known to them through personal contact, and where there is doubt concerning the eligibility of the applicant.*

*5. **"Occupational and Experience Record"** should be complete. Month and year ("From-To") for each job should be specific. "Position Held" should be clarified. "Duties Performed" should be complete and in detail. Titles are very misleading. As a toolmaker, a man would not be eligible, except in cases where designing or tool engineering experience is included. These factors can be clearly determined only if complete information is given.*

*6. **Applicant's Signature, in Ink,** should be affixed in space provided on the reverse side of the application.*

*7. **Signatures of Two Chapter Officers Required** — All applications should be signed by the Membership Chairman of the Chapter and at least one other Chapter Officer. These signatures do not denote approval, but merely indicate to the National Membership Committee that the application has been reviewed by them.*

*8. **Complete Chapter Recommendations** should be given with each and every application, such as "Suggested for Junior," "Suggested for Senior," "Suggested Not Acceptable,"—(Give reasons for your recommendation). Intelligent recommendations can be given by checking with references listed on the front of the application and by contacting the applicant's employers (past and present).*

*9. **Do Not Hold Applications!** Please have all applications reviewed and signed, as soon as possible, after they are submitted to the Chapter, forwarding them to Headquarters for final consideration by the National Membership Committee. In some cases applications have been held from six months to a year by the Chapters where they originate. This discourages interest and stimulates hard feeling toward the Society.*

*"**This Is Not a Must!** We would, however, appreciate having a photograph of the applicant attached to his application, so that it may be available for possible use in the Society's publications.*

***Remittance Form F-201 PMR** (Prospective Members — Payments) must be properly filled in and attached to each application or group of applications and remittances forwarded to National Headquarters.*

The rejection of a good man (or woman), through lack of information, can harm the Society by antagonizing an applicant who may know members with comparable experience, or who may have friends in similar positions, who would be discouraged from attempting to join ASTE.

Chapter officers have expressed approval of the new bulletin which is helping them to build high-quality membership.

New Legal Calendar Aid Chapter Operation

Hartford, Conn.—National Constitution and By-Laws Chairman Irwin F. Holland has compiled for his committee a chronological schedule of the official events prescribed in the laws under which the Society operates.

I. F. Holland

In substance, the legal calendar sets forth:

At the regular January Meeting, each Chapter is to elect a Nominating Committee. Those serving on this Committee must be members in good standing.

***February** — The Nominating Committee is to report at the regular Chapter Meeting, and the election of the officers is to be held in accordance with Section B 12-3 of the By-Laws, and R 4-4 and R 4-5 of the Rules. Only members in good standing should be nominated as candidates for elective offices.*

***March**—Newly-elected Chapter officers are to be sworn in to take office, at the regular Chapter meeting held in March.*

Nominating Committees, from the various Chapters in a Region, are to meet and select nominees for Regional Directors on alternate years when an election is required for their Region.

Names of nominees for Regional Directors must be sent to National Headquarters on or before April 1st.

At the Annual Directors' Meeting held in March, the National Nominating Committee will report their nominations and all National Officers must be elected at that meeting.

The annual report is to be presented at the Annual National Membership Meeting, as provided for in Section C 15-1 of the Constitution.

A report on the Chapter election must be submitted to the National Secretary, c/o National Headquarters, on forms furnished by the Society, not later than the first week of March.

***April**—The new Chapter officers take over Chapter operation on April 1st.*

At the regular April meeting members should be reminded that dues must be paid before May 1st when all members not in good standing are suspended, and lose their right to vote and receive the official journal

Those whose dues for the preceding year are still unpaid on May 1st will be removed from membership in the Society.

***July**—National Headquarters will prepare ballots for election of Regional Directors and mail them to the members in participating Chapters on or before July 15th.*

National Headquarters will check eligibility of nominees before preparing ballots.

***August**—Balloting for Regional Directors closes on August 15th.*

***September**—Newly-elected Directors are to be certified by National Headquarters, on or before September 15th, to take office on October 1st.*

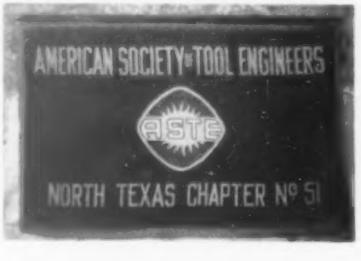
***October**—The National Nominating Committee for nominating National Officers will organize at the Semi-Annual Meeting in October, and prepare to function as provided in Section B 5-2 of the By-Laws, as amended.*

***September-June**—Monthly meetings are to be held and conducted by each Chapter as specified in B 12-4 of the By-Laws.*

All proposed Chapter activities should be carefully scrutinized for any deviation from the ideals and purposes of the Society. Co-operation in guarding against detrimental practices will enhance our present public prestige. Prompt attention to required procedures accelerates the National machinery and assists Headquarters in rendering efficient service.

Texas Banner Makes Trip To Syracuse

Dallas, Texas—North Texas is so proud of its ASTE banner, which graces all Chapter meetings, that they sent it to the Syracuse convention in the custody of John Lapham, Regional Director, affiliated with this unit.



The 4 x 6 feet gold-fringed, blue ensign, bearing the Society and Chapter name in gold letters with the ASTE emblem as the central motif, was displayed during the Semi-Annual Meeting where it created interest among other Chapter representatives.

British T. E.'s Outwit Enemy

London, England—How the continued operation of the Tool Room in one of the city's war plants has been possible because of precautions taken to protect this vital spot, is related by Andrew H. Pettican, Member-At-Large, in a recent communication to National Headquarters.

His narrative, which follows, is another testimony to the fortitude of his nation after years of destructive warfare:

London, England

Dear Sirs:

Many thanks for the Indianapolis Convention Papers. While I am writing, you might like to know that the monthly arrival of "The Tool Engineer," "ASTE News," and the papers provide something to look forward to, especially now that we are getting the bombing again.

Our works, lying along the railway (in peacetime, no doubt, good practice) has had more than its fair share of damage. No doubt, if Jerry had been using Yankee bomb sights, the railway would have suffered and not us.

I sincerely hope that your engineers in the States never have the experience of seeing the results of years of labour ruined in one night by enemy action. It is tragic to see finely-built American and British machines ruined and mixed with shafting, concrete and steel girders bent and twisted to most fantastic shapes.

I well remember seeing a sight feed lubricator, the glass of which had become distorted through the heat generated by an oil bomb. It had assumed a facial expression similar to that seen on Toby jugs. All our engineers appreciate now what heat can do.

Of course, we soon learnt the technique for getting the works going quickly again after a raid. It is very simple—get a taxi or a car as soon as possible and travel round to the electrical contractor, power station, builder, gas company, water board, and so forth, bringing representatives back with you.

We slipped up badly on the first occasion, sitting back trying to telephone everybody concerned. After an hour or so we realized that there were very few telephones or exchanges in operation, so we took the car. By the time we arrived at the various places where we wished to contact people, most of them were out on other blitz jobs. So the motto must be "Up in the morning early and out with the car."

We were very fortunate with our tool room. Care was taken at the start of the war to reinforce the walls, brick in the windows and protect the roofs with timber and sandbags. In addition, it was fed with very short gas and electric mains independent of the factory mains, so that, in the event of breaks in the regular line mains, the tool room plant could function while repairs were taking place elsewhere.

The trouble we had taken was well repaid because we have not had one hold-up in the tool room, although we must admit that this did not have a direct hit in the same way as other parts of the works. As you all realize a sound tool room is a wonderful asset when the rest of the works is in real trouble.

It has been a tremendous tonic for us to read of your high production figures. When you think that we knocked off work during the winter blitzes at about 4 p.m. so that the girls could get home before the sirens sounded, you can probably realize what those figures of yours meant to us.

I, personally, have had the experience of not being able to make my nightly, twenty-minute train journey home, through enemy action, but instead have had to hop from bus to bus, or tram, in order to get home, the journey taking about one and a half hours, by a very devious route.

Of course, the nights that we stayed at the works, firewatching would no doubt have suited some of the more jovial ASTE members. It was the practice of the management to provide a barrel of beer for refreshment, and I shall always remember the remark of a member of one particular squad, about not being able to stand the physical strain of firewatching.

Apparently, they had stayed up playing cards and having a drink or two until about 1:45 A.M. and, after they decided to retire, the sirens started blowing at about 2:30 A.M., with the result that they did not get to bed again that night. You can imagine that, with plenty of beer and no sleep, they were not feeling too good next day. It was not the practice to stay up late after that, except for "alerts."

It was rather an eerie business making the rounds while a raid was at its height. We used the space between the fire doors on the various landings as strong points and, as soon as the noise of the planes died down a little, we would make a dive for the next strong point, keeping our eyes open all the time for any incendiaries which might have started fires.

I have rather rambled on, but have probably said enough to indicate that our headaches are not always production problems.

I should like to wish you all the very best of good fortune in the coming period.

Yours sincerely,
Andrew H. Pettican

Our very best to you and your countrymen, Mr. Pettican. May the New Year bring brighter days.

Cemented Carbides Applied To Industry

Windsor, Ont. — The sixty-eight members and guests of Chapter 55, who met at the Prince Edward Hotel January 8, heard a profitable presentation of "Cemented Carbides and Their Application to Industry" by Charles Neal, Manager, Carboloy Division, Canadian General Electric Company, Toronto.

An educational and instructive discussion period followed Mr. Neal's talk which was illustrated with slides.

Two interesting films on Television in the Home and Frequency Modulation Radio completed the program.

Opening Day At Syracuse Convention

Left to Right (Seated): Registration Crew—Elizabeth Gilroy, Alma Kreaser, Elinor Collins, Helen Vielie, and Genevieve Root of Syracuse Convention Bureau. (Standing) ASTE Convention Office Staff—Doris Pratt, Charles Hasse, and Maxsine Erickson of National Headquarters.

Syracuse Host To Semi-Annual Meeting

Three hundred and seventy-one members from 43 Chapters, and 163 guests, were registered during the three-day Semi-Annual Meeting at Syracuse, October 12-14, 1944.

Excluding the host Chapter's registered attendance of 99, Rochester sent the largest representation of any visiting group—38 having been affiliated with this unit. Binghamton had a delegation of 27, Toronto, Buffalo, and Detroit, 19 each; Hartford, 13; Northern New Jersey, 11; and Twin States, 10.

Fewer members were present from distant Chapters, partly because of limited hotel accommodations and difficulties in securing return transportation.

The large ratio of non-members registered is an indication of the appeal our technical sessions have for those outside the Society.

LIBERTY BELL REPAIR PROVOKES RINGING ISSUE

Cleveland Member Proposes Arc-Welding Job

Cleveland, Ohio—A communication from W. J. Conley, Consulting Welding Engineer, Lincoln Electric Company, to Hon. Sam Rayburn, Speaker of the House of Representatives, recommending an outlined procedure for restoring the Liberty Bell by arc-welding the crack, has reverberated throughout the land, by press and radio, as well as in Congress.

W. J. Conley

The local ASTE'er said in his tradition - rending letter:

Dear Mr. Speaker:

The purpose of this letter is to make a recommendation to the Seventy-Eighth Congress of the United States.

The Lincoln Electric Company, Cleveland, Ohio, for which I am the authorized spokesman in this matter, recommends that the Liberty Bell be restored so that the people of the United States, and of other nations, may again hear this famous bell ring out in the true, full tone befitting the symbol of liberty.

Engineering studies made by the undersigned, a welding consulting engineer for the Lincoln Electric Company, world's largest manufacturer of electric arc welding equipment, disclose that it is practical to repair the crack in the Liberty Bell, by welding.

The findings from these studies are submitted with the recommendation that you turn them over for consideration by the proper committee of Congress and that this Congressional committee, in turn, select a committee of experts from the American Welding Society, who would decide on the exact procedure to be followed for repairing the Liberty Bell.

These findings are:

This bell weighs just over one ton, is 12 feet in circumference around the 3-inch thick lip, 7 feet 6 inches around the crown where the thickness is 1¼ inches. The height up to the crown is three feet, while that over the crown is 2 feet 3 inches. It is practical to repair the crack in the bell by welding. The method used should be the manual arc, using carbon electrodes.

The technique would consist of preparing the edges along the crack by scarfing away the metal. Before starting the cutting to prepare the edges, a ¾-inch hole should be drilled at the very upper end of the crack over the crown, making certain that the hole removes all of the end of the crack.

Preheating of the whole unit to a temperature of between 200 and 300 degrees Fahrenheit would be necessary due to the fact that the large mass of metal in the bell of high heat conductivity would otherwise conduct the welding heat away too rapidly to do a perfect job. This can be done by mounting burners so as to play on the inside while the welding is done from the outside and vice versa.

The bell should be mounted so that beads can be placed alternately first from the outside and then from the inside to equalize shrinkage stress. Peening will be necessary and this must be controlled so that the metal will not be overworked, since this casting contains about 20 percent tin. The peening of the weld should be done while cooling from the heat of the arc in the temperature range from 1200 degrees Fahrenheit to 400 degrees Fahrenheit.

Carbon electrodes ⅜ or ½ inch in diameter should be used in water-cooled holders so that large amperage direct current (450-500) can be applied, the smaller electrode to be used for the first beads.

The filler metal should be phosphor bronze of approximately the same content as that of the bell, namely: 20 percent tin, 80 percent copper. The composition is higher in copper than others of that period, since on the second recasting one and one-half ounces of copper was added for each pound of the casting.

The bell can be repaired by following the procedure outlined.

It seems particularly fitting that this recommendation should be carefully considered by Congress as the day approaches when Victory will be won over the enemies of Liberty. On that day and in the days to follow, let the symbol of Liberty be heard by the miracle of radio across the land and around the world just as the principles of Liberty established in America by our forefathers have reached throughout the world.

Could it be restored?
ASTE'er Conley says, "Yes."

Very truly yours,
W. J. Conley
Consulting Welding Engineer
The Lincoln Electric Company

Reactions to Mr. Conley's scheme have been controversial, such as: Senator Reynolds (D-N.C.): *Never! It should be left in its sacred cloister.* Rep. Disney (D-Okla.): *Why not? . . . We lead a radio life nowadays, and to have its ringing heard over the air would keep the youngsters reminded of the fact that there is an old Liberty Bell.*

Buffalo (N.Y.) Express: *Everyone recognizes the Liberty Bell as a symbol of the freedom ringing in every American heart. The familiar crack in the old bell is all right, too, serving as a reminder to all of us that our liberties are perishable and can be sustained only by a lively sense of popular responsibility and by continued individual respect of the rights of others.*

Albany (Ga.) Herald: *The Lincoln Electric Company's recommendation is certainly worthy of careful study by Congress.*

Morris L. Cooke, prominent engineer and former custodian of the bell, relating its preparation by engineers for the journey to the San Francisco Fair in 1914: *They installed a "spider" in the bell. The "spider" is still inside the bell and should not be removed. That alone would keep the bell from ringing. The engineers discovered also that . . . a hairline crack extends around the circumference of the bell, near the lower lip.*

The famous relic is owned by the City of Philadelphia and reposes in Independence Hall.

Mr. Conley is well-known to many of our Chapters through his several, excellent welding lectures which are available to ASTE groups in most cities of the United States and Canada.

Capital City Man Assists FEA

Washington, D. C.—Characteristic of this Chapter's contributions to the functioning of the many governmental departments located here is that of Andrew R. Benedictus, Principal Engineering Analyst for the Foreign Economic Administration.

Since being called to the Board of Economic Warfare nearly two years ago, Mr. Benedictus has been active in various divisions of that agency and its successor, the present FEA, where he is engaged on production engineering studies in the machine tool and small tool field, and in the implementation of general policy matters.

A. R. Benedictus

His experience in machine tools, production and inspection methods in connection with the metals working industry has been extensive, both in this country and in Europe. Before the war Mr. Benedictus was director of the machine tool importing firm, Etablissement Henri Benedictus of Brussels, Belgium, which represented some of the foremost American manufacturers.

L. A. Groups Visit Kaiser Plant

Los Angeles, Calif.—More than 700 members and guests of this Chapter made a trip to the Steel Division of the Kaiser Company, at Fontana, Calif., November 10. As there were over 1500 reservations requested, it was necessary to arrange a second tour on November 17.

Admission Tax Liability Defined

Detroit, Mich.—Complying with requests from Chapters for a decision on the problem of computing Federal taxes on admissions to ASTE functions, David E. Roberts, General Counsel for the Society, has prepared an opinion, approved by the Miscellaneous Tax Division, Dept. of Internal Revenue, Detroit.

In his brief, Mr. Roberts quotes Treasury Department Regulations 43, Section 101.19, governing the obligations of printers in producing tickets for any purpose involving an admission charge, and reading:

"Sec. 101.19 PRINTING OF TICKETS—NOTICE TO BE GIVEN—Where tickets or cards of admission to any place for admission to which a charge is made are printed, manufactured, or sold by any person, it shall be his duty to give prompt notice to the Collector of Internal Revenue of the district in which is located the place to which admission is to be charged. The notice shall state (1) the name and address of the person to whom the tickets are furnished and (2) the number of tickets furnished, and shall be accompanied by proofs or sample copies of the tickets themselves. If the tickets are serially numbered, the notice must also include a statement as to such serial numbers."

He points out, further: "It is obvious, however, that the directions given to the printer by the officer or committee in charge of the meeting or banquet should be specific in form. For example, if a ticket is printed

ASTE ANNUAL DINNER	
Admission	$5.00

the tax will then be levied on the total admission price of $5.00 at the rate of 20%, or $1.00 per ticket.

"In the event that the ticket is ordered in the following form,

ASTE ANNUAL DINNER	
Dinner	$3.00
Service	.30
Admission	1.37
Federal Tax	.27
City Tax	.06
	$5.00

the tax will be levied only upon the admission charge of $1.37, and the item of $3.00, if actually paid for the dinner, is not considered taxable, nor is the 10% service tip. Prevailing state and/or city taxes, if any, should also be ascertained and calculated in the price of the ticket.

"Considerable stress, therefore, must be laid on the committee or officer in charge of drafting the form of ticket to be followed by the printer. We can no doubt assume that the majority of the printers are acquainted with the provisions of the Act but, if the secretary of the chapter or national association is fully instructed, he can make certain of the correctness of the tickets.

"It is the duty of every organization to make a report, on Treasury Form 729, to the Internal Revenue Department by the end of the month following the month during which the affair was held, and to forward the required tax in order to evade penalties for non-payment.

"Another problem has apparently arisen amongst the local Chapters which have failed to file reports and pay the required taxes, or, upon investigation, have been assessed on the full price of the ticket because of the lack of breakdown relative to the various types of expenditures.

"It is our experience that all such assessments could be satisfactorily adjusted if the fiscal officer of the chapter so affected would secure a duplicate, receipted invoice from the club or the hotel where the affair was held, showing the actual price of the meal, and mail it to the Internal Revenue Department, accompanied by a check in payment of the tax on the remainder of the cost of the ticket, which represents entertainment, and so forth. This matter would be handled at the Internal Revenue office of the district where income taxes are paid.

"A more difficult question arises, however, in computation of the tax on the admission and dinner charge where a group takes over a public club or cabaret, sitting in a separate section, having some of their own entertainment, but also partaking in the use of the public dance floor or being in a position to observe the public entertainment. No definite rule has been drawn on this situation as yet, but local Internal Revenue conferees are of the opinion that the 30% cabaret tax on the full ticket price might be charged. It would be well for the officers or committee of each group to make some inquiry on this point, where such an affair is planned."

Specific problems not covered by the foregoing should be referred to local Internal Revenue officials, before proceeding with the printing of tickets.

Cleveland Chairman Wins Promotion

Cleveland, Ohio—Karl H. Meyer's appointment to the managership of the newly-enlarged Marine Division was recently announced by The Reliance Electric and Engineering Company.

Karl H. Meyer

Mr. Meyer, Chairman of Chapter 3, ASTE, has been with Reliance ever since his graduation from Case School of Applied Science. Before his advancement, he was superintendent of the Marine Plant as well as works engineer at the main factory.

His company produces motors, generators, electrical drives, and specialized power equipment. The Marine Division will concentrate on the long-run production of smaller equipment.

Chairman Meyer has been active in his Chapter, ever since he joined ASTE in 1940, having served as Constitution and By-Laws, Reception, and Membership Chairman, and Chapter Treasurer, in addition to his present office.

Chapter Activities in This Issue

IS YOUR CHAPTER REPRESENTED?

(See article on Page 65)

Glenzer Tools
Speed Production

From the first Glenzer Utility Sleeve designed and manufactured over a score of years ago, to the latest addition to the line—these tools combine inventive ingenuity and practical production know-how in precision design.

That's why they are designated as standard by some of the largest automotive and airplane manufacturers as well as thousands of other manufacturers.

GLENZER TOOLS STAND THE TEST OF TIME

Each was designed to meet a specific need—to do some certain operation better, quicker, more accurately, longer than it had been done previously.*

Include Glenzer precision products in your production plans for now and for post-war change-overs.

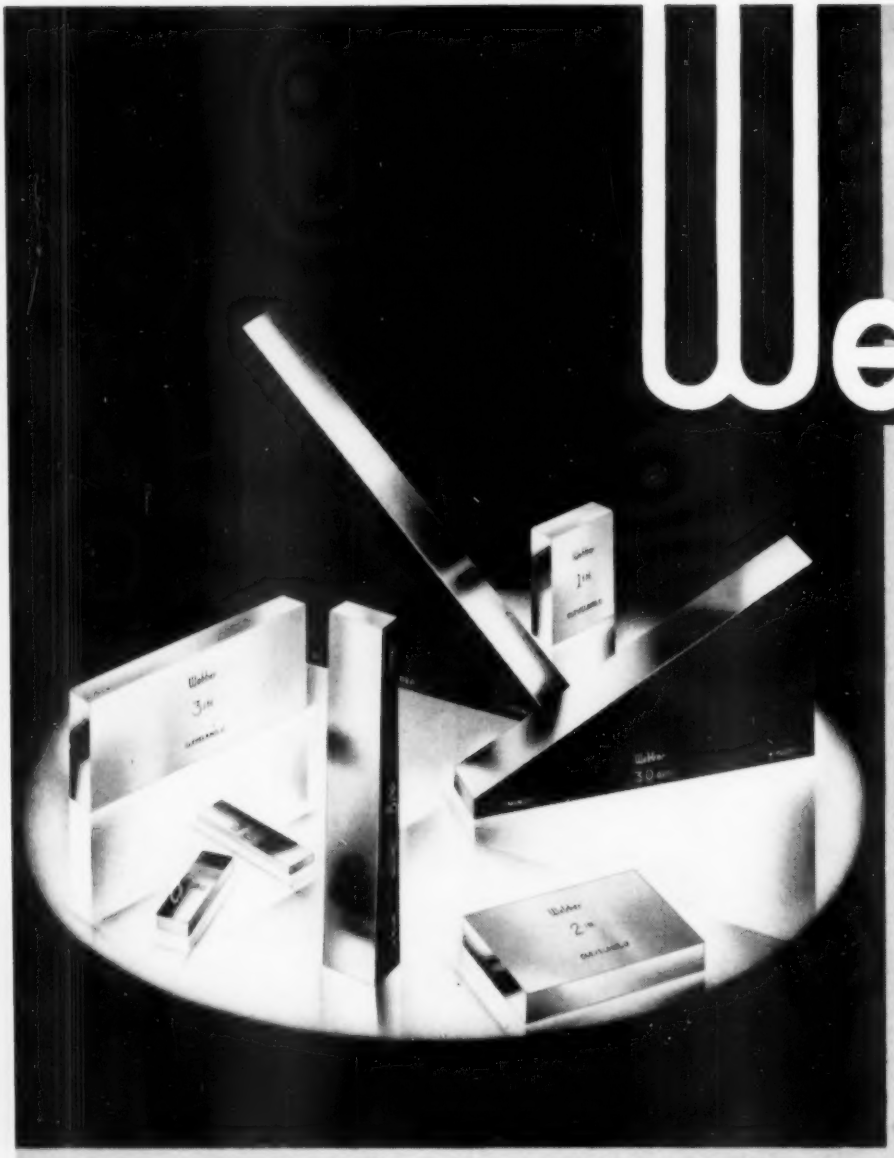
*See our announcement on page 122 of this issue.

THE **J. C. GLENZER CO.** INC.

6567 Epworth Boulevard — Detroit 10, Michigan

Tear off and check items on which you want literature.

Adjustable Extension Assemblies	End Mills	Sleeve Holders
Adjustable Adapters	Extension Sockets	Spacing Collars
Core Drills	Floating Holders	Tap Chucks
Counterbores	Live Centers	Tool Drivers
Drill Chucks	Quick Change Chucks	Spot Facers
	Reamers	Woodruff Cutters



Webber offers more than just ACCURATE GAGE BLOCKS

Investigate Webber Service after the Sale!

● Dimensional Accuracy – Stability – Surface Finish – Wearing Quality are inherent qualities of all Webber Gage Blocks. They are the result of years of research – long experience in making precision gage blocks – the combination of modern methods of production under ideal conditions – and the exclusive manufacture of precision gage blocks.

Thus Webber assures dependably accurate measurements on every step of your production from tool room to assembly. But Webber *service* doesn't stop here. It provides complete facilities for inspection – and replacing worn or damaged blocks at a moderate cost.

The Webber 84-A Set of gage blocks contains two .100" wear blocks and one .10005" block in addition to the regular blocks in the set. This adds immeasurably to the life of the set and makes possible about double the number of measurements of the average set.

Webber service also includes an Angle Gage Set permitting the accurate measurement of 370,800 angles up to ¼ second of an arc – easily and quickly.

Webber Gage Sets are furnished as follows –

Set No. 84A–$350.00 **Set No. 84B–$235.00**
Set No. 43A–$185.00 **Set No. 43B–$150.00**
Set No. 38A–(Thin Blocks) $195.00
Set No. 38B–(Thin Blocks) $155.00
Set No. 14A–(Angle Blocks) $450.00

(Continued from page 40—"Production Control")

and $1.00 to $4.99, also all fast moving items, four months apart; two counts a year on items costing $.05 to $.24 and $.25 to $.99, six months apart; one count on parts costing less than $.05, $.005 to $.009, $.01 to $.04, all inactive parts and assemblies, and all obsolete parts and assemblies.

One of Management's problems is to educate their workers to the dollar value of parts. When parts are found on the floor of a stockroom, it is the same as money, yet the worker does not seem to realize this and to him it is just so much stock, copper, brass, etc.

The control of inventories is industry's number one problem.

It is hard to understand why some companies will insist on two or three Vice Presidents reviewing and signing requests for authorizations of $5,000.00, $10,000.00, $20,000.00, $50,000.00, etc., yet a production man will place orders with vendors and in the factory to the extent of one half million dollars and not one Vice President will sign the authorization. If the production man does not use good judgment and parts are over ordered to the extent that they become obsolete and must be scrapped, only then is it brought to the attention of the Vice President and at that time it is too late to act because the damage has been done.

The Eleventh is Cost Analysis.

It is very important that the Engineering Specifications are correct because from these records requisitions, labor cards, etc., are prepared and if they are wrong the cost figures will be incorrect. Some industries are checking cost variations after each completed operation instead of waiting until the entire order is completed which may be from four weeks to three months. It is extremely hard for the foreman or worker to remember what happened four weeks to three months ago when a production order is being checked in order to find out why it cost so much more to make the part this time than it did the last time.

The Twelfth is Contract Termination.

Most industries have selected an Executive to head up this most important department. He in turn has selected a capable staff. It is the duty of this department to study and list contracts, sub-contracts, prime contracts, patterns, jigs, dies and small tools. They must make plans for the lay-off of personnel when and if such time arrives where they are compelled to do so. Different methods of control are in use, some concerns have set up visual boards showing the progress of the parts in production. Inventory tickets have been printed so they will be available when needed.

When a contract is terminated it will be necessary to segregate government machine tools. Locate and tag the number of parts in stock and in process. Set aside a positive location in the stockroom for parts affected, tagging them by Contract Number, Part Number and Order Number. Stop all work in sub-contractors and suppliers plants. Inventory all government owned property in sub-contractors and suppliers plants. Get statement of charges from sub-contractor and suppliers plants.

Speedy Records Essential

Speed is essential. Inventories should be listed of raw material, parts and assemblies as soon as possible.

Work in process must be listed up to and including completion point. If it takes two or three months to do the job you are losing interest on your money. We have punched a set of cards showing every machine tool in our factory. We use form codes. 1—IBM; 2—Defense Plant Corporation; 3—Navy; 4—Ordinance. When the war is over we will be able to make a listing at once showing what tools will be returned as well as those that could be converted for our own use providing the government wanted to sell them. These cards placed in an IBM Accounting Machine produces a report showing Department Number, Group of Machines Number, Description of Machines, Brass Tag Number, Serial or Defense Plant Corporation Number and Code Number.

By running our Stock Status Summary Report we will have a listing by contract number, part number, Quantity in Stock and Quantity on Order. By sorting the Labor Cards in the factory control stations we will be able to list the locations of every part and completed to such and such an operation.

There never will be a perfect production or manufacturing control system due to four things. 1. Engineering Changes. 2. Breakdown of Machine Tools. 3. Scrap Work. 4. Human Element.

Constant Improvement Inevitable

The company which ceases to have Engineering Changes to reduce cost and better the operation of their product will soon be out of business. The best machine tools available at some time or other will break down due to the fact that anything mechanical is apt to fail. When the best operators make some scrap, the good and fair operators are sure to have some of their work scrapped.

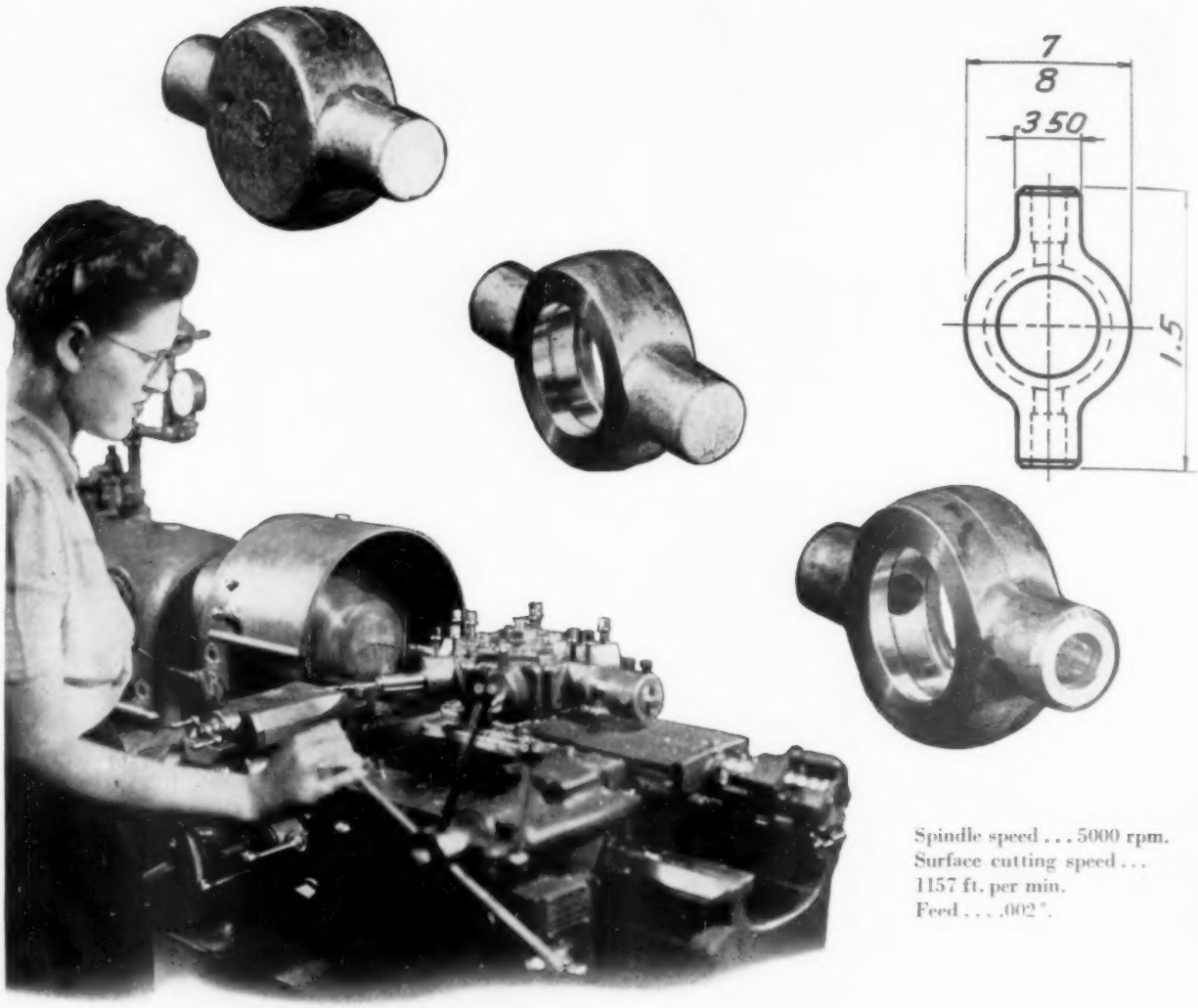
The human element is management's number one problem because workers must be taught how to do things correctly and not make too many mistakes. The person who never makes a mistake, either does not have enough work to keep him busy or he is on the wrong job. We learn and benefit from every mistake we make. However, we should not make the same mistake twice. The point is that "It is not so important who is right, but it is very important what is right.

Carboloy Opens Two New Branches

To provide expanded and speedier service to users of Carboloy cemented carbide cutting tools, Carboloy Company, of Detroit, has established branch offices in Milwaukee, Wisconsin, and Houston, Texas. The first is located at 743 North 4th St., Milwaukee, and the latter, at 924 M & M Building, 1 Main Street, Houston 2, Texas.

Frank J. Staroba, representing Carboloy in Wisconsin since 1940, and A. F. Schlumpf, a carbide specialist, trained at the Detroit plant of Carboloy Company, will make their headquarters at the Milwaukee office.

In charge of the Houston office will be A. J. Rod, Carboloy Sales and Service Engineer who is especially familiar with carbide applications in Southern Texas because of his work with G. F. Cotter Supply Company.



Spindle speed . . . 5000 rpm.
Surface cutting speed . . .
1157 ft. per min.
Feed . . . .002".

FROM FORGING TO FINISH IN 168 SECONDS ON A *Monarch Production Lathe*

At spindle speeds of 5,000 rpm., Monarch 10″ Production Lathes make short work of finishing this brass forging for aircraft lubrication systems.

The first operation drills, reams, grooves (in bore), faces one side and chamfers 3 edges in 50 seconds, floor to floor.

Next, the other side is faced and one edge chamfered, in 18 seconds, floor to floor.

Finally, 2 diameter holes are step-drilled, the other end is faced and chamfered, in 50 seconds for each end. Total time, 168 seconds from floor to floor.

Such cutting speeds would not be possible were it not for Monarch's improved lubrication method for the precision bearings, permitting cool, distortionless, high precision machining. With stepless range of speeds, simple tooling, quick operating cycle and ease and speed of control, these Monarch 10″ Production Lathes turn out more work per day . . . at lower costs.

When their war work is finished, they'll be quick to go into peacetime production, because their ability to cut costs will be as important then as their speed is now. If you are interested in applying Monarch 10″ Production Lathes to your work, our engineers will gladly help you.

THE MONARCH MACHINE TOOL COMPANY · SIDNEY, OHIO

BRANCHES:

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Monarch Saves Time

THIS AIR MOTOR

Can Pay for Itself in less than 48 hours

IN ADDED PRODUCTION ALONE

THESE EXTRA BENEFITS ARE FREE!

- **Less Worker Fatigue!**
- **Fewer Work Rejects!**
- **Longer Tool Life!**

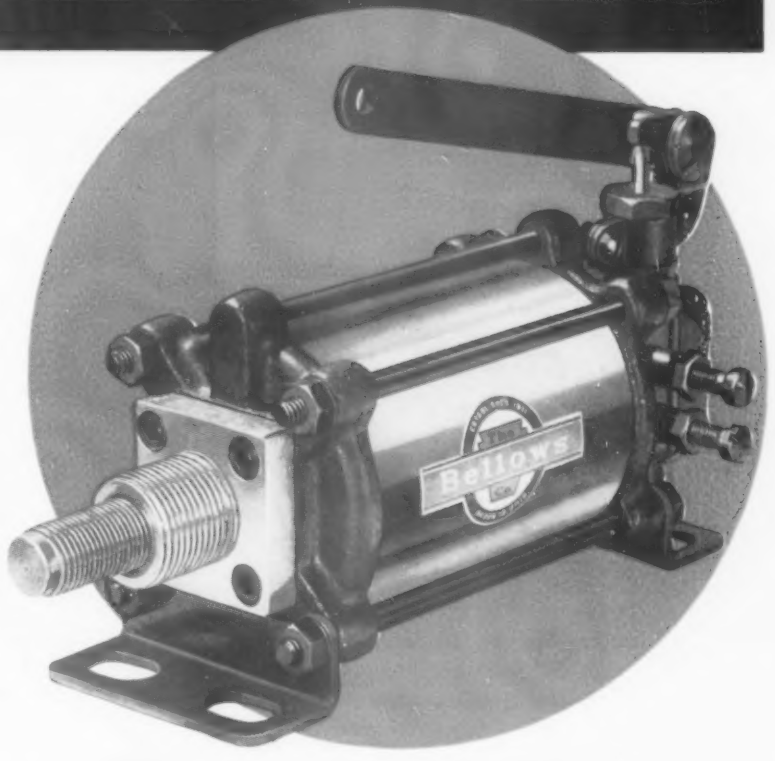
CONVERTING slow, hand-operated machine tools to fast automatic production units by the use of Bellows Air Motors is quick, and inexpensive.

Operations involving repetitive, rhythmic manual motions, such as in feeding work or tools, opening and closing collets, vises and fixtures, clamping and unclamping, can be performed faster, safer, better by Bellows Air Motors — enabling one worker frequently to do the work of two, with less fatigue, greater personal safety, and fewer work rejects.

The elimination of repetitive manual operations frequently more than doubles production — more often than not pays for the installation of Bellows equipment with the first week's production increase.

Here's a typical case: A mid-western manufacturer had a production job which consisted of pushing two pins to a uniform depth in a shell fuse. He was obtaining 350 per hour by the use of an arbor press method. A single Bellows Air Motor jumped production to 800 per hour. In the new system pins are hopper fed to the fixture. The Bellows Air Motor, foot controlled, sets the two pins in one operation. Both hands of the operator are left free to handle the work.

This operation is completely described in our new Photo-Facts File AM-1 showing typical installations of Bellows equipment in plants all over America, together with a record of production accomplishments, and cost data. We'll be glad to send you a copy without cost. Write today



Engineering Data YOU'LL WANT TO KNOW

Integral Valve — The Bellows Air Motor is a complete air-driven power unit with integral valve and operating controls.

Easily Synchronized — The operating lever is adjustable to any angle in any plane for easy synchronization to the machine cycle.

Speed Controls — Speed of piston advance and retraction is independently controlled and subject to unlimited variation.

Power — Piston thrust force approximately 4.9 times operating air line pressure. Operates on any pressure up to 175 lbs.

Strokes Available — Standard stock stroke lengths are 1½", 2½", 6", 9", 12", 15", and 18". Special lengths from 1" to 48" on order.

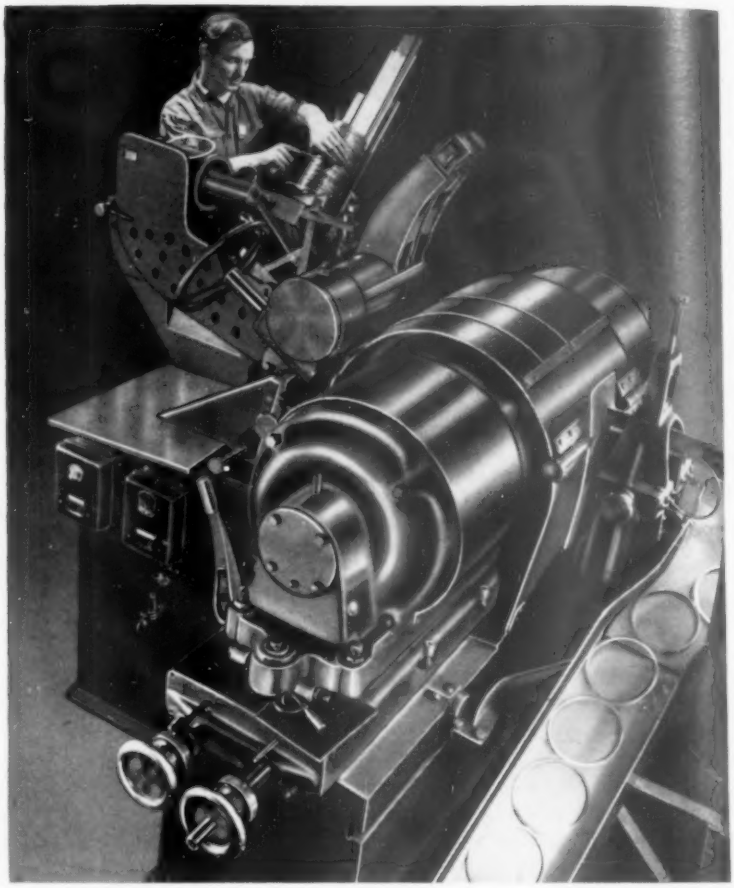
Size — Overall height—4⅛", overall width—3½", overall length —stroke plus 6-25/32".

The Bellows Co.

862 E. TALLMADGE AVE. • • AKRON, OHIO

PARALLEL SIDES PRECISION-GROUND AT THE SAME TIME --AT HIGH PRODUCTION RATES

HANCHETT
Double Spindle
Disc Grinders
Do it Every Day



These No. 221 Hanchett Double Spindle Grinders are rough and finish grinding piston rings at a high production rate. Bearing races, retainer rings, turbine blades, thrust washers, springs plus a multitude of other similar parts are rolling off Hanchett Badger Grinders daily.

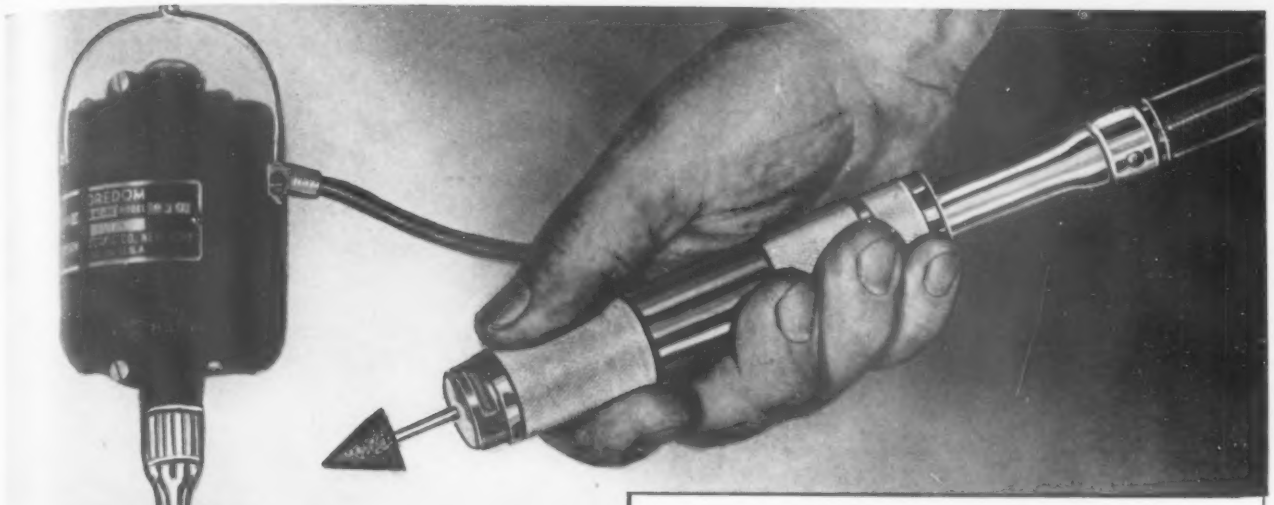
One of the six sizes of Hanchett Double Spindle Grinders can be quickly adapted to meet your production requirements . . . fully automatic, semi-automatic or hand operated. Cast-iron, molded products, die castings, plastics and other materials of various sizes and shapes are being ground on these Hanchett "Badger" Grinders. Holding to close tolerances while maintaining consistent high production output is, as always, a built-in Hanchett engineering principle. Our engineers stand ready to help you.

Ask your nearest Hanchett dealer or write for Bulletin 640-1TB

HANCHETT GRINDERS — BIG RAPIDS MICHIGAN

IF IT'S A FLAT SURFACE—THERE'S A HANCHETT TO GRIND IT

HANCHETT MANUFACTURING CO.
BIG RAPIDS, MICHIGAN U.S.A.



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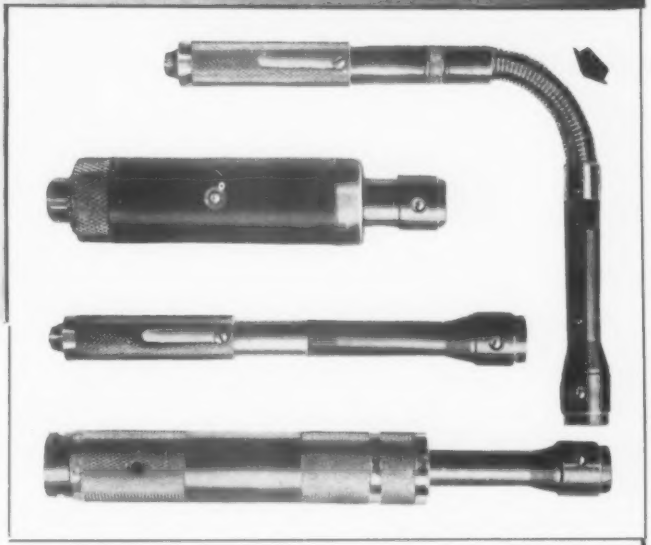
AMERICAN INDUSTRY for DE-BURRING and LIGHT GRINDING and FINISHING JOBS

Foredom Flexible Shaft Machines are employed in many thousands of plants for grinding, finishing, polishing, de-burring, milling, cleaning, etc., replacing old-fashioned, time-killing hand methods. Foredoms are used in 3 key departments—production—tool room—maintenance. Among the leading industrial plants employing Foredoms are Ford, General Motors, Chrysler, Nash-Kelvinator, Jack & Heintz, Sperry Gyroscope, Bendix, Westinghouse, etc.



4 Quickly-interchangeable handpiece types—pencil sizes and larger—some with flexible wrist—see arrow.

Models from $17.50 to $48.75. Catalog No. 38 shows complete line and many uses—may point the way to solving some of today's production and maintenance problems. Write for your copy.

★ ★ ★ ★ ★ ★ ★ ★ ★

Another Foredom Time-Saver

GRINDING KIT, Model 111

One of Foredom's complete line of versatile utility grinding kits preferred by so many plants for emergency and maintenance needs. You too will find it pays to spot them liberally about your plant. Pencil-size handpiece facilities getting into tight corners for touching-up production set-ups. Complete with accessories $23.50.

Order from your regular Mill Supply House or direct.

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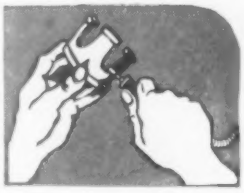

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Please send me your new catalog No. 38 showing the different uses of Foredom Flexible Shaft Machines.

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Sure the early bird gets the worm, but how about the bird who is unavoidably late? Someone ought to take care of him and Hartford Chrome does! While we don't encourage last-minute work, we have the facilities to give you prompt chrome plating service when you re in a jam.

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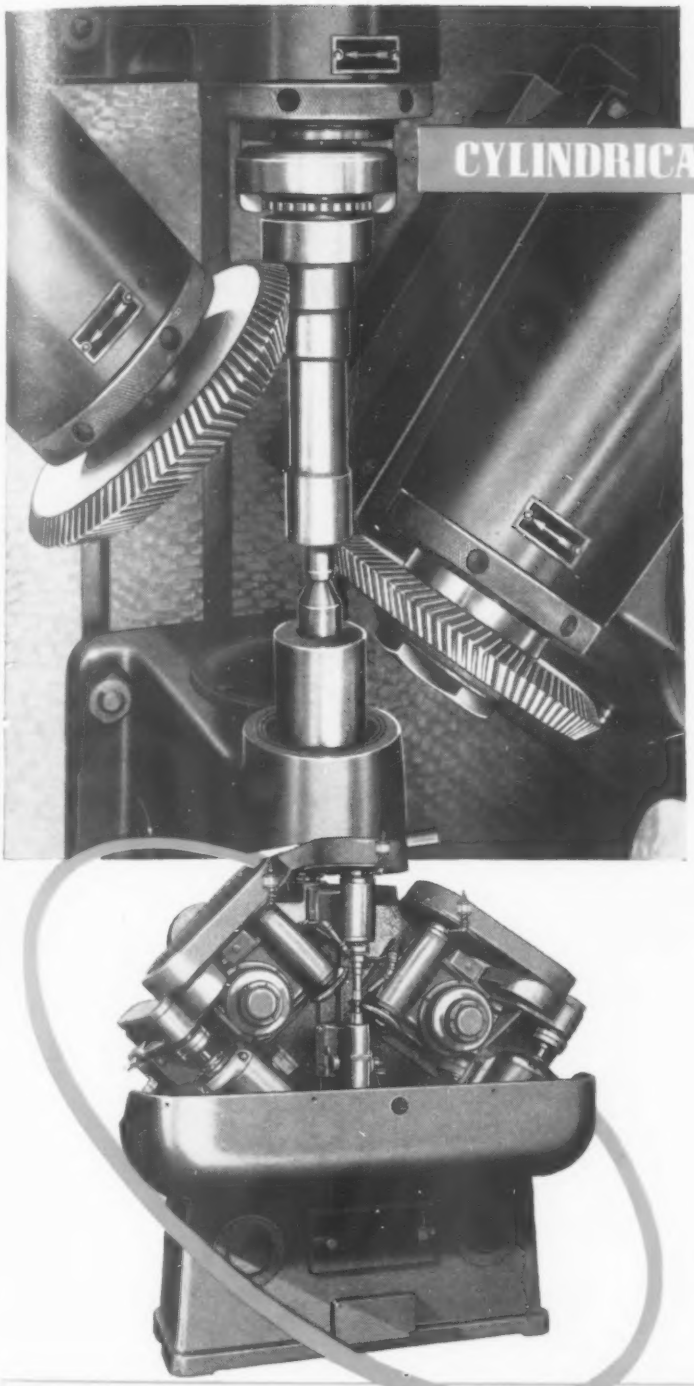
ROTO SHAVING



Finishes

CYLINDRICAL and CONICAL SURFACES

Faster and Better

On parts having a hardness of 38 Rockwell or less, Roto Shaving is better than grinding because it is faster, more economical and the finished surfaces can be maintained to a high degree of smoothness. Production rates are about three times that of grinding.

A 100% complete inspection of a lot of 4,000 consecutive pieces reveals a maximum variation of .001″ on the diameters. Stock removed ranges from .010″ to .015″ on the flanges and .020″ on cylindrical dimeters.

A special fine pitch milling cutter is used for this work and the work is rotated during the cut but at lower speeds than for grinding. These cutters wear very slowly and may be sharpened on ordinary shop equipment. The gradual wear materially reduces machine adjustments.

NATIONAL BROACH AND MACHINE CO.

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Specialists on **SPUR AND HELICAL INVOLUTE GEAR PRACTICE**

Originators of **ROTARY SHAVING AND ELLIPTOID TOOTH FORMS**

INDUSTRY POLL POINTS TO PLAN-O-MILL!

Here's how PLAN-O-MILL measures up to Industry's demand

The Bramson Publishing Company's

PRODUCTION POLL

of the Metal-Working Industry

• Staff editors of this publication believe the answers to these questions may guide readers toward an enlightened outlook on postwar mass production. Answers gathered from the field, from the more than 20,000 readers of this magazine and at its PRODUCTION Round Tables each month, will undoubtedly reflect the thinking of the metal-working industry in the U. S. and Canada.

QUESTION	Per Cent Replying YES	NO
1. Do you envision greater precision in postwar manufacturing?	50%	50%
2. Where advisable, will you replace pre-war equipment with war-built or D P C equipment?	70%	30%
3. Are changes in machine tools indicated to fully utilize improvements in cutting tools?	100%	—
4. As a general rule, should machinery controls be changed so as to provide greater motion economy on the part of operators?	100%	—
5. Do you favor electronic controls?	93%	7%
6. Are lubrication systems on machine tools today efficient, adequate and accessible?	3%	97%
7. Do you see a trend toward a reduction in stock removal for finish, by such means as precision forming, casting, forging, stretching etc.?	94%	6%

inadequate. The ... of color ... PRODUCTION Round ... points

July 1944—*Tool Engineer.*

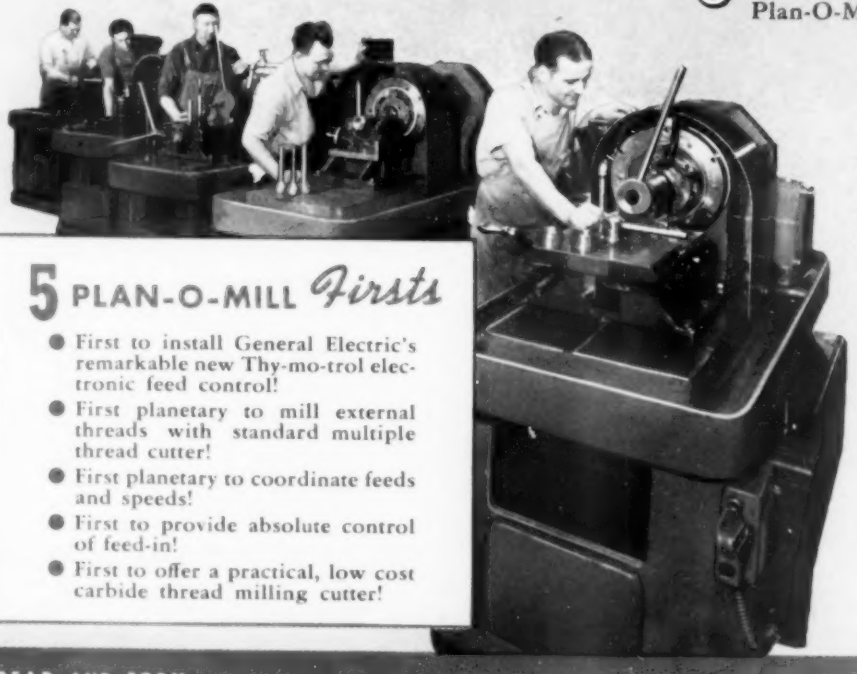
1 Plan-O-Mill does a precision job at a production rate.

3 Plan-O-Mill is up to the minute in efficient use of cutting tools, either high speed steel or carbide.

4 Plan-O-Mill is electrically controlled—one push button for complete cycle.

5 Plan-O-Mill was the first planetary to install electronic feed and speed controls.

6 The answer is "YES" for Plan-O-Mill.



5 PLAN-O-MILL *Firsts*

- First to install General Electric's remarkable new Thy-mo-trol electronic feed control!
- First planetary to mill external threads with standard multiple thread cutter!
- First planetary to coordinate feeds and speeds!
- First to provide absolute control of feed-in!
- First to offer a practical, low cost carbide thread milling cutter!

If your war or postwar products involve internal or external threading, or cylindrical forming, now is the time to replace obsolete, wasteful machines with Plan-O-Mill. Contact your machinery dealer or write direct.

THREAD AND FORM PLAN-O-MILL MILLING MACHINES

PLAN-O-MILL CORPORATION

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THREAD AND FORM PLAN-CO MILLING CUTTERS

TOOLS OF TODAY

Internal Grinder Has Mechanical Oscillating Mechanism

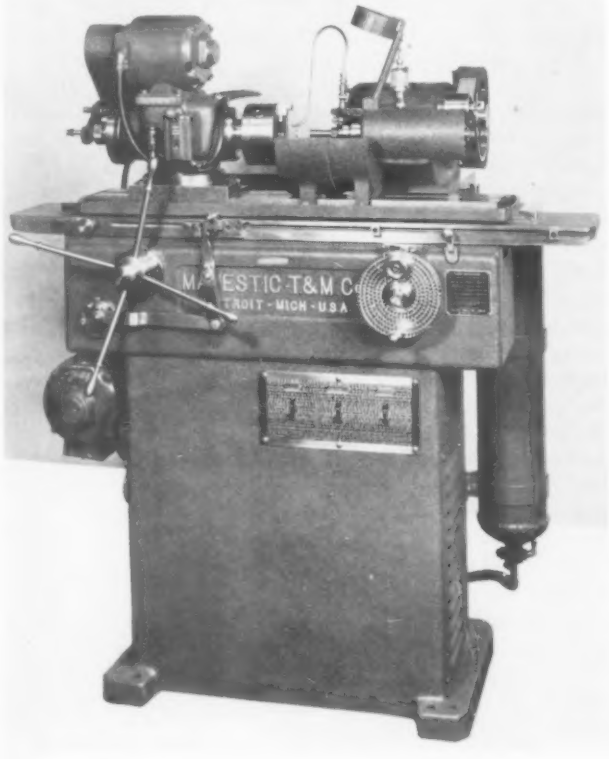
INCORPORATING a mechanical oscillating mechanism, the Parker-Majestic Internal Grinder is said to offer advantages of considerable interest to industry. These are: Super-finish quality with speed of operation, accuracy and uniformity on production grinding, and greatly enhanced productivity.

The oscillating motion is positive drive direct off the power feed unit. Engagement is automatic, the oscillating arm engaging into a lock, secured on the table, immediately on running the wheel into the hole to be ground. It is then locked by a spring operated trip lever, when motion starts without hesitation between the manual operation and time of engagement. Raising the lock trip by hand disengages the mechanism.

Stroke is quickly and easily adjusted by means of a knurled screw on the eccentric drive plate conveniently located at the front of the machine. Stroke is from zero to 1 inch, with number of strokes per minute 64, 84, 104 and 124, this range covering about 90 per cent of all applications. However, power feed provides for longer stroke when so desired.

As seen from the photograph, the machine is clean cut, ruggedly designed and well proportioned, with controls readily accessible. Provided with swivel head and graduated table, the machine will grind straight or tapered holes, is adapted for external as well as internal grinding, for dead or live center drive, for power or manual operation, and is filtered for clean, fine finish grinding, all in addition to the oscillating action.

The machine is a product of Majestic Tool & Mfg. Co., 2950 E. Woodbridge, Detroit 7, Mich.



Gear Cutting Revolutionized by Michigan Tool Company

A NEW MACHINE, known as *Shear-Speed* (Fig. 1), that may entirely revolutionize the mass manufacture of small gears, is announced by Michigan Tool Company, Detroit. Long a leader in the field of precision gear finishing, the company has had the machine under development for several years until, in its marketed form, it is said to be capable of rough and semi-finish of gears at the rate of 60 to 100 per hour, depending on the job.

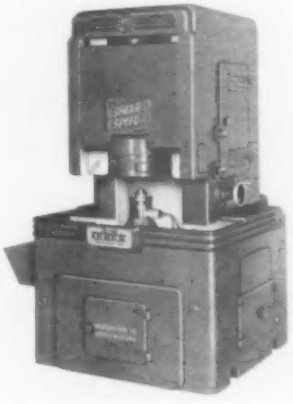


FIG. 1

Essentially a shaping machine, *Shear-Speed* cuts all teeth simultaneously with radially in-fed form tool blades having a sheer cutting action. There is no indexing, since the number of teeth in the cutter corresponds with the number of teeth in the gear. Thus, all of the teeth are cut in the time ordinarily required for one. Cutting time on the 51 tooth, 4 inch gear shown in Fig. 3, for example, is well under one minute.

The objective, on the part of the maker, was to coincide gear cutting with the production level set by modern gear shaving machines. Up to now, one gear shaving machine has been capable of handling the output of a number of shapers or hobbers, the ratio varying according to the nature of the job. With *Shear-Speed*, however, rough or finish cutting, and shaving, can be practically synchronized and predetermined—i.e., one *Shear-Speed* and one shaver can now be depended on to produce continuously a definite number of gears per unit of time.

The first of these machines to be made available is the 1843, designed for gears up to 4″ diameter × 2″ face, which probably covers the range of the most widely used gears at this time. Shoulder gears—as in Fig. 4—are easily handled on the machine, the action of which is similar to that of a shaper, while it is also readily adaptable to helical gears. In addition, it is said to provide the simplest method so far evolved for rough and semi-finish cutting of involute splines.

The machine, which is said to be exceptionally easy to operate, is especially suited to semi-skilled operators. Starting is by push button. The operator merely places the blank on the work holder, when chucking is automatic and part of the machine cycle. The cycle completed, the machine automatically returns to loading position and releases the workpiece, when a new blank is loaded and the cycle repeats. There are no loose arbors, or nuts to tighten.

The cutting action of the machine is as follows: When the gear is clamped, the cutter head automatically lowers into cutting position and locks into position. The work then reciprocates vertically, with all blades advancing radially inward an equal amount. On the return stroke, blades are retracted slightly to provide tool clearance. Feed rate is adjustable, and

correct sizing is adjustable and automatically controlled.

For "inching," when setting up, a "jog" control is provided, also, adjustments are provided for speed of vertical reciprocation and length of stroke. Cutting pressure, around the gear, is balanced by virtue of the multiple blades; this also affects its vastly higher rate of output. To change to new work, the entire inner cutter head assembly (Fig. 2), is removed as a unit and another head inserted. By a similar procedure, cutters are removed and replaced for sharpening; one head is removed and a replacement installed, when production is im-

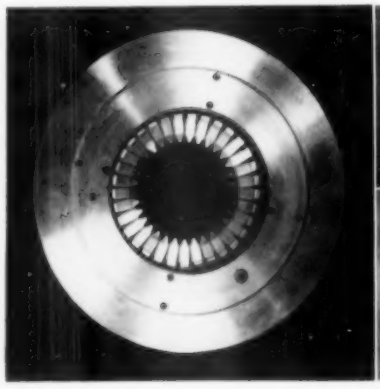


FIG. 2

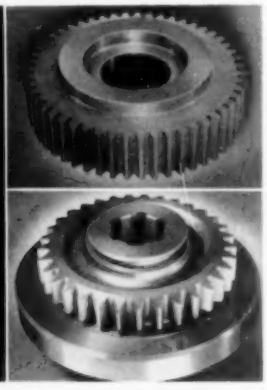


FIG. 3 AND 4

mediately resumed. A simple grinding operation restores blades to correct form.

As features of design and construction, the machine is exceptionally rigid and safe to operate. And, as previously stated, deflections are minimized because of the balanced cutting action. In view of the high rate of metal removal, special provision has been made for chip clearance. Cutting fluid, supplied from the base of the machine, is directed on the work under relatively high pressure to wash out chips.

The machine is readily accessible for adjustments or repairs, with large openings in the base and column to facilitate any adjustments that may be necessary for the interior mechanism. Electric and hydraulic control circuits are equally accessible. These features, however, are taken for granted in modern design. The outstanding *feature*, outside of nicety of engineering and manufacture, is its high productivity made possible by the simultaneous cutting of all teeth.

"Roundtest" Gages

AN ENTIRELY NEW type of plug gage, trademarked *Roundtest*, is announced by Yankee Precision Products Company, 965 Farmington Avenue, West Hartford 7, Connecticut.

Designed for "go" and "no go" production gaging, these gages conform with modern practice in that they are carbide tipped, for extended life, on the wear surfaces.

An additional feature of design is that the carbide tipped surfaces conform to the true arc of the work. By rotating the gage, then, one may test for roundness and reject holes that are out of round at any point. As claimed, this is a more certain test than is usually possible with standard round gages.

A Sunstrand Machine With "Brains"

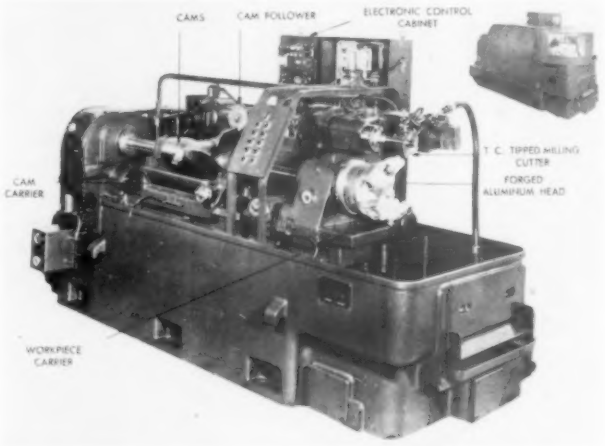
ENTIRELY IN LINE with ultra-modern trends, the Sundstrand Machine Tool Company, Rockford, Ill., has built a special machine which, while designed for milling circular, partial and dome fins on a forged aluminum cylinder head, has unlimited possibilities in the field of mass manufacture.

The machine has combination electric and hydraulic controls, and handles in two operations, on one machine, work that previously required four machines and four operations.

Of unusual interest is the automatic electrically controlled feed rate, which varies automatically from 6" to 60" per minute with the rate depending entirely on the depth of cut and HP consumed. The cutter follows an irregular path which changes in shape and depth for each successive fin, yet, with electronic control, the cutter remains loaded to capacity.

Once loaded, machine cycle is fully automatic. The operator just pushes a button, when the cutter and cam roller rapid traverses to within ⅛" of the cut. The work piece then starts to rotate with the shaft that carries the master cam. Next, the pivot arm feeds the cutter into the work until the roller contacts the cam, which then controls the path of the cutter until a complete fin has been cut.

As the next step, the pivot arm—hydraulically actuated—rapids the cutter from the part and the roller from the master



cam, when the work-cam carrying shaft rotates—in rapid—back to its starting position. The cam carrier and work carrier slides then index laterally, bringing the next cam into position under the roller and the work piece into position for cutting the next fin. And so on, continuing automatically until all fins have been cut, when the slides index back to starting position and the machine automatically stops.

A set of cams—one for each fin—control the irregular path of the cutter. Providing direct cam control to both cutter head and cam follower roller, both are mounted on a single casting which pivots on widely spaced bearings. Also, the master cams and work piece are mounted on one splined shaft, this eliminating any possibility of error between the rotation of the two. The work piece is rotated, through its feed-rapid traverse cycles, by an electrically controlled feed box, with linear, station to station index through a positive index plate and lead screw.

The work is enclosed throughout the cutting cycle, and, the machine being automatic, one operator should run a battery under ordinary manufacturing conditions—i.e., as operators run batteries of automatic screw machines or gear cutters.

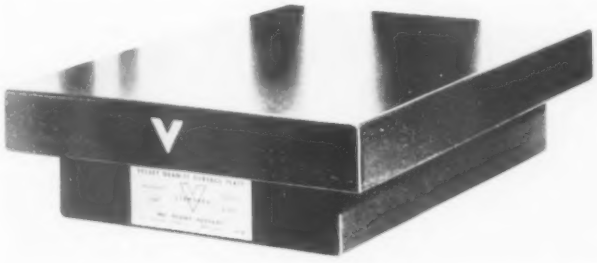
Everything considered, the machine incorporates the mechanical or electronic "brain" which is destined to be a feature of postwar production machines.

Velsey Surface Plates

IN THE VELSEY Surface Plates, distributed by the State ufacturing and Construction Company, Franklin, Ohio, k diamond granite is the material specifically used. This is eous rock composed of feldspar, quartz and mica. The on occurred in plutonic heat eons ago and, under tremen- s pressure, cooling was so slow that the mass had time to dify in large, perfect crystals. Having been seasoned for then, and molecularly inert, it is claimed that this ma- al cannot be warped or otherwise distorted by any condi- s to which a surface plate may be subjected.

The Velsey surface plates are lapped to a tolerance of 0005" surface flatness. This flatness is not changed by shock temperature fluctuation, and, because the material is harder than tool steel, it cannot be scratched by instruments. It is claimed that even if the surface were nicked by a heavy blow, the adjacent material would not be upset nor would precision be affected. And, since the material cannot corrode, oxidize, abrade or warp, a Velsey Surface Plate should last indefinitely with ordinary care.

While regular sizes are 12" x 18", 18" x 24" and 24" x 36",

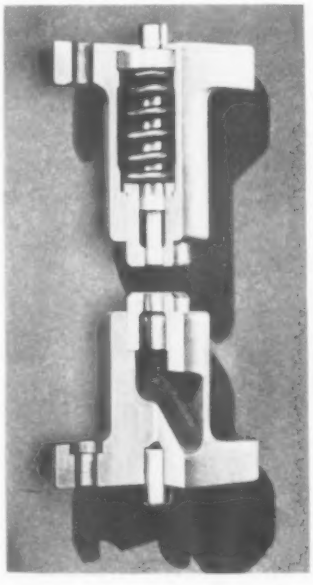


with special sizes made to order, the black granite is obtainable in such great blocks that surface plates can be fabricated to any practical dimension.

Full information and quotations may be obtained by writing direct to the distributor.

Hole Punching System

THE NEW WALES "CD" Hole Punching System is announced by Wales-Strippit Corporation, North Tonawanda, N. Y. This system consists of Type "CD" hole punching units, templates, locator rings, adjustable stops, feed rails and drill templates. With these parts, making a perforating die is a simple assembly job with many time and money saving advantages.



The "CD" hole punching units consist of 2 parts —punch assemblies and die assemblies which are independent and self-contained for quick, easy mounting to templates, then to die sets or for direct mounting to die sets. The punch assembly consists of a punch holder, stripping spring and guide in exact relationship to the die assembly. The latter consists of a holder with a built-in slug clearance chute, a die and pilot pin. The pilot pin in the punch assembly is part of the punch.

Full information regarding these units may be had from the maker.

Disintegrator for Broken Tools

A PERENNIAL problem to industry, now greatly aggravated by war production and its incidental unskilled help, is the removal of broken tools, as drills and taps, that have become embedded in workpieces during process of manufacture. Often enough, these parts are costly, and just as often, removal by any of the so-called conventional methods may prove so costly that scrapping is preferable to salvage.

In line with recent developments, however, removal is now effected with electrical disintegration, whereby the core of the tool collapses, when the remaining fragments of the outer shell may be easily removed. Utilizing this technique, the Clinton Machine Company, 8240 Harper, Detroit 13, is manufacturing a disintegrator known as the Thomas Tap Extractor.

The method embodies a hollow electrode which, by means of a solenoid controlled vibrating head, intermittently contacts the center of the broken tool. With each "make and break" of the circuit, an arc is struck which produces a localized area of high heat, with incidental oxidization, at the core of the tool. This, combined with the severe contraction which results from a flood of coolant flowing through the hollow electrode, tends to shatter or disintegrate the core of the tool, the particles of which are washed away by the coolant. Heat is confined to the area contacted by the electrode, without danger of annealing, distorting or burning adjacent surfaces of the workpiece.

The hollow electrode—and the vibrator head—can be conventionally chucked in a drill press or otherwise set up to feed to the body of the broken tool. The Thomas head can be set at any angle from horizontal to vertical, or it may be used inverted. The electrodes are non-ferrous and range from .040" to .312". The coolant, which is special, is filtered and runs in a closed circuit.

Current is supplied through a transformer at voltages ranging from 2 to 12 volts—harmless to the operator. Also, working temperature, for disintegration, is only about 130 degrees F., so that there is no danger of distorting the workpiece during the process of removing broken high speed tools.

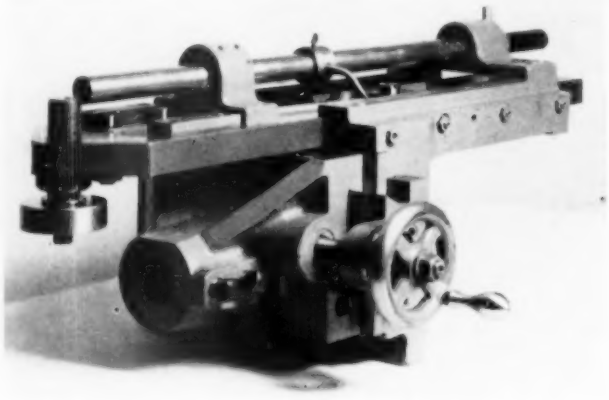
In operation, the workpiece is clamped to the table of the machine and the suspended electrode or tip is centered over the broken tool. The current is turned on, and the coolant brought into play, when the tip is lowered to contact the work. Disintegration begins immediately and proceeds at the rate of about 1/32" per minute, the actual rate of feed depending on the size of the broken tool.

Of especial interest, the Thomas Extractor can be applied to "disintegrating" holes through hardened steel parts when, as sometimes happens, drilling has been forgotten before hardening or where supplemental operations call for a hole after heat treating.

Taper Attachment For Turret Lathes

THE ARTISAN TOOL and Cutter Company, Ferndale, Mich., is manufacturing a taper attachment, known as the REEVES, and designed for inside taper boring. The attachment, which will fit most hand screw machines or turret lathes, and which is adaptable to some Bullards and chucking machines, will do straight boring as well.

Because the device is provided with a sine bar, and is quickly mountable and demountable, it is claimed that it can be set up, within a matter of minutes, to accuracy within



.001". By use of a profile bar, one may also do simple profiling. Accuracy may be consistently maintained, taper in first piece being correct for all subsequent parts.

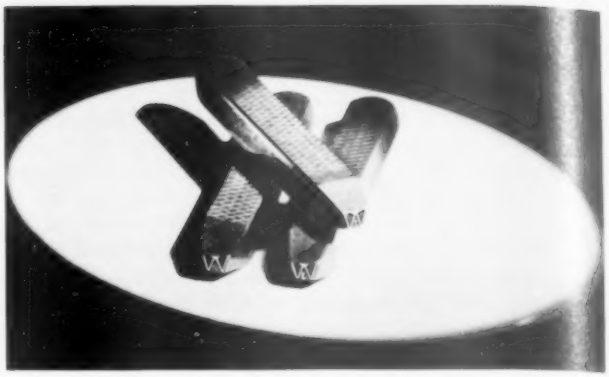
Medium sizes—as for Warner & Swazey 2-A or similar—may be had on 30 days or less delivery. Full information may be had by writing the makers at 531 Vester Ave., Ferndale 20, Mich.

Diamond Tool Kit

AS AN INNOVATION in diamond tool packaging, the Abrasive Dressing Tool Company, Detroit, announces a new Abrasive General-Purpose Diamond Tool Kit.

The *Abrasive G-P* or "*jeep*" *Kit* consists of ten diamond tools, two tool holders and two keys for locking tools in the holders. Included are diamond dressing tools, radius tools, cutting tools, phonopoints and a diamond scriber—enough to meet practically every requirement of medium size and small plants.

Each kit bears an identification number and provides a separate compartment for each tool, facilitating inventory and preventing loss. The *Abrasive G-P Kit* is available for immediate delivery.

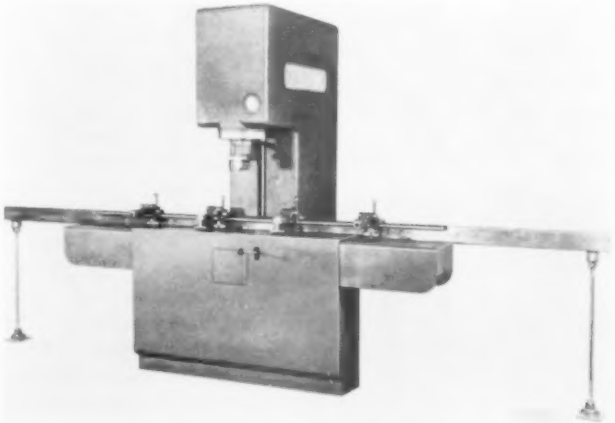


"Roundface" Stamps

HAND STAMPS WITH "Round Face" characters, designed for the low stress marking of lightweight alloy forgings and castings, are currently available from New Method Steel Stamps, Inc., 147 Jos. Campeau, Detroit 7, Michigan.

This line of hand stamps is particularly suitable for marking aluminum and magnesium alloy parts which will be subject to either tensile or torsional stresses in service. As shown both face and impression are rounded on these new stamps. Use of round face stamps lessens the chances of cracks starting in the forgings or castings so marked; in this respect, their rounding has an effect, as compared with sharp face stamps, similar to that of a fillet, rather than a sharp corner.

All characters have been designed in accordance with S.A.E. aeronautical specifications which call for impressions not deeper than .003" and fillets (radius of curve) of not less than .006" at all intersecting surfaces of an impression. Shanks are provided either plain or knurled.



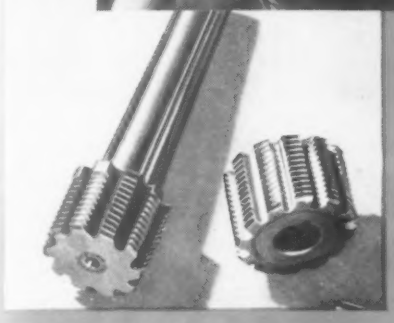
Hydraulic Straightening Press

BULLETIN No. VL 1-44, now available on request from Colonial Broach Company, P.O. Box 37, Harper Station, Detroit 13, describes the new Colonial Model VL-1 Hydraulic Straightening Press. These open side presses are of welded steel construction, provided with built-in motors and are rugged throughout.

Rams are operated by direct acting hydraulic cylinders in the head and are accurately controlled through light pressure combination hand control and foot pedal. The Bulletin lists standard and extra equipment and gives specifications of models ranging from 10 to 50 tons capacity.

Do it with DALZEN

Left: Dalzen taps, in U. S., Metric, Whitworth, and Special forms are precision ground of hardened high speed steel in a complete size range. TUNGSTEN CARBIDE TAPS — EITHER SOLID OR INSERT — A SPECIALTY.



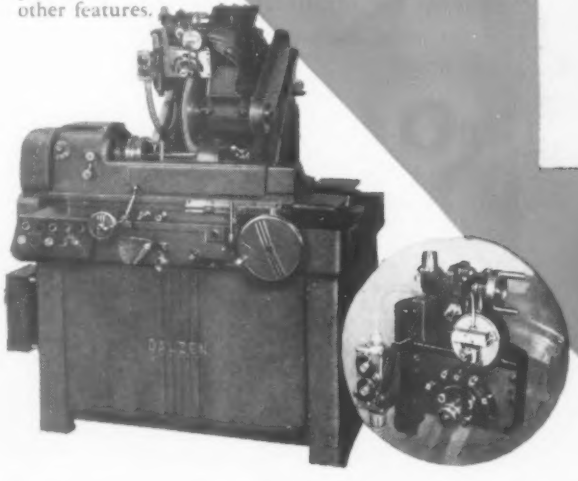
Left: High speed ground thread milling cutters, scientifically heat treated for longer cutting life.

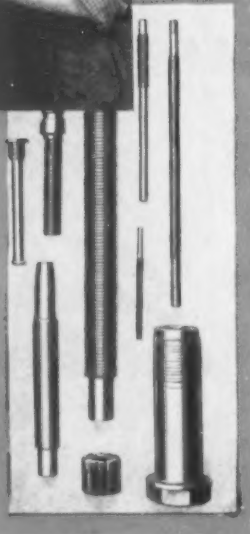
Dalzen manufactures an extensive line of precision cutting tools, parts, thread grinding and special machines — engineered for maximum efficiency and economical operation. Each is the result of years of experience on the part of designers and craftsmen. These are reasons why, all over the United States and in many foreign countries, master mechanics who have used and worked with Dalzen-made machines and tools say, "You can do it better with Dalzen." Write for details on how Dalzen can "do it better" for you.

Below: Dalzen "2-in-1" combines a dependable, accurate center lapping machine with a sturdy drill press. Saves on equipment costs, floor space.

Below: No. 5 *Electronic* Thread Grinder. Easy to operate. High production efficiency and accuracy by controlled wheel speed, motor driven dresser, automatic compensation and other features.

Right: No. 2 Thread Grinder. Compact, upright design saves floor space. Simple to operate. Low first and maintenance cost. Ideal for short or production runs.



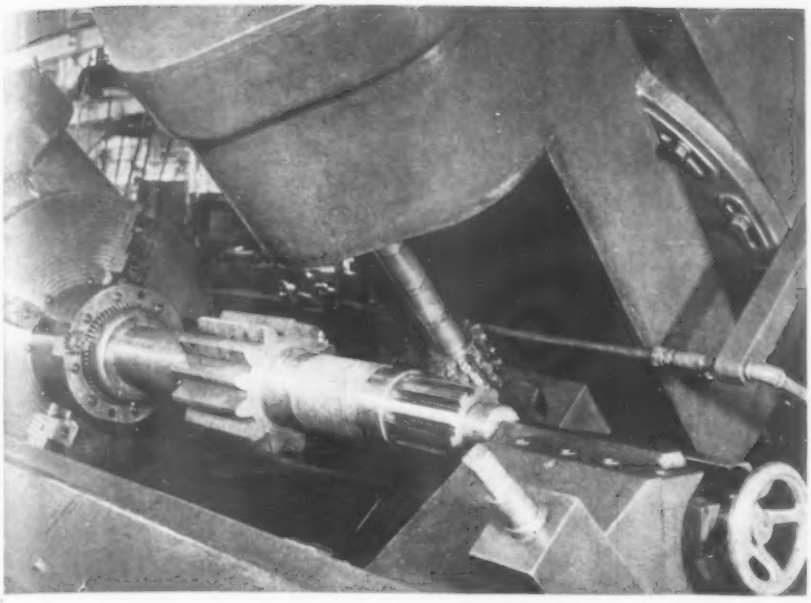


Right: Threaded parts are ground to close tolerances exactly to your specifications. Rigid inspection standards assure a uniform fine finish. Jobs requiring rolled or cut threads are also handled.

DALZEN

TOOL AND MANUFACTURING CO.

12255 EAST EIGHT MILE ROAD • DETROIT 5, MICH.



High-Speed Hob Cutting Splines at Lima Locomotive Works

From Blueprint to Product

An important operation in Lima Locomotive Works, Incorporated, Lima, Ohio, is the cutting of splines. The picture shows a vertical swing shaft with the National Tool hob cutting splines on a Simplex Hobbing Machine.

The spline section is 5" O.D., 10 splines .780" width of spline, the spline section being 5" long. The material is S.A.E. 4140 steel with a brinell hardness of 225-265. The spline is finished complete in one cut, the hob operating at 45 R.P.M. with a feed of .009 per revolution.

NATIONAL TOOL PRODUCTS

BROACHES • HERRINGBONE CUTTERS
SLITTING SAWS • COUNTERBORES
REAMERS • GEAR SHAPER CUTTERS
GEAR CUTTERS • MILLING CUTTERS
CIRCULAR AND FLAT FORM TOOLS
HOBS, GROUND AND UNGROUND
SPECIAL TOOLS

National Tools are the Shapers of Progress

NATIONAL TOOL Co.
11200 MADISON AVENUE CLEVELAND, OHIO

How TO OVERCOME SPINDLE MISALIGNMENT!

—and Simplify Tapping and Reaming

The easiest way of overcoming misalignment between the spindle and the work, in tapping and reaming, is to use a tool holder so designed that it compensates for such inaccuracies, even though they amount to as much as 1/32 of an inch.

This is what the Ziegler Tool Holder does! And because it does it automatically, it greatly simplifies tapping and reaming, reducing spoilage losses from oversize and bell-mouthed holes, and also reducing set-up time. Try it and see how it will increase your production rate and at the same time enable you to turn out work that meets the highest standards of precision.

Made To Fit Any Machine

Furnished with male or female taper, straight, threaded or special shanks to fit any machine used for tapping or reaming.

WRITE FOR CATALOG

W. M. Ziegler Tool Co.
1930 Twelfth St.
Detroit 16, Mich.

Ziegler ROLLER DRIVE FLOATING HOLDER for Taps and Reamers...

GOOD READING

A Guide to Articles of Interest and Significance in the Trade Press

An Appraisal of Precision Thread Rolling Practice. Frank Oliver in November 16 *Iron Age*. A comprehensive analysis of the fastest known method of external threading.

Aluminum Bronze Extrusion. Frank J. Miller in December *Metals & Alloys*. A timely and significant article that not only deals with the tools and methods of extrusion, but which also makes available to engineers a comparatively new metal in finished shapes that, previously, could only be roughly attained by casting.

Veteran Re-employment Aids Chart, which covers a very timely problem. November *Mill & Factory*.

Evolution of Steel Balls. December *Western Machinery and Steel World*. A pictorial as well as a verbal portrayal of the ball from the glacially eroded round stone to the precision steel ball used in modern ball bearings. An interesting and highly educational article.

Mass Production in Ship Building. Howard Campbell in January *Modern Machine Shop*. An outline of huge scale tooling for the mass manufacture of ocean going ships.

Direction of Cut Affects Forces in Milling. M. Martellotti in January 4 *American Machinist*. Meaty reading for production men who want to get the most from milling cutters.

Also, in the same issue: **Tray Improvements Brought About By Wartime Use of Pusher Furnaces.** By Joseph Sammon, Chief Foundry Engineer, the Driver Harris Company. Deals with the design of grids and trays for stress annealing and heat treating.

The Big Freeze. J. H. Van Deventer in Dec. 28 *Iron Age*. An editorial on trade cartels that should be read by every believer in free enterprise.

Classification and Symbols for Identification of Domestic High Speed Steel Tools. By L. Clayton Gorham, President, *Gorham Tool Company*, 14400 Woodrow Wilson, Detroit 3, Mich. A booklet (now in 4th. edition) that gives a complete history of the classification system outlined in this issue of *The Tool Engineer*.

An Interesting Ball Bearing Dispenser. Leo J. Otten in November *Screw Machine Engineering*. An ingenious tooling, developed for use with Brown & Sharpe automatics, that has very broad applications.

Types of Jigs for Light Drilling Operations. C. W. Hinman in November *Canadian Machinery*. The concluding installment of a series, the article, which is profusely illustrated, is of especial interest to students of tool design.

Cast Metals Handbook. 3rd. revision, '44. Published by American Foundrymen's Assn., 222 W. Adams St., Chicago. A comprehensive treatise on the engineering properties of cast metals. $6.00.

Surplus Reporter

As Announced by the Procurement Division of the Treasury Department, the first editions of the "Surplus Reporter" were issued Nov. 29, 1944. These editions were for Hardware and General Products classifications. Following, at intervals of ten days, additional editions covering Furniture, Machinery, Automotive, Textiles and Wearing Apparel, Medical and Surgical, Paper and Office Supplies, will be issued until all eight divisions are covered.

Issued from each regional office, the "Surplus Reporter" will advise firms on Treasury's mailing list what the Treasury has to sell, the area where located, and general method of selling. It will no longer be necessary to contact each of the eleven regions as to what surpluses are available since available goods nation-wide will be listed by each regional office.

Purchasers will contact the regional office and indicate items in which they are interested. If disposition is to be made by invitation to bid, forms will be sent, and if sale is to be by field, price or negotiations, purchaser will be so advised.

No General "Invitations to Bid"

However, the new system portends the end of automatically sending invitations to bid. Rather, those interested will request invitations on specific items after having received notice through the "Surplus Reporter" of what is available.

The new plan is designed to cut down, enormously, the amount of paper and manpower consumed in disposing of surplus, and furnish complete information of things to sell.

Hereafter, the Washington Office of Surplus Property will act as a policy, pricing and directorial staff. Sales will be made from Regional offices in each of which there are eight commodity departments similar to those in Washington. A marketing specialist, who is a seasoned business man and familiar with trade practices in his particular field, will be in charge of each.

Treasury's eleven regional offices of Surplus Property and the states they comprise are as follows:

REGION I —*Connecticut, Maine, Massachusetts, New Hampshire, Vermont, Rhode Island*
Regional Office, Park Square Bldg., Boston, Mass.

REGION II —*New York, Pennsylvania, New Jersey*
Regional Office, Empire State Bldg., 61st fl., N.Y., N.Y.

REGION III —*District of Columbia, Delaware, Maryland, North Carolina, Virginia*
Regional Office, 1126 21st St., N.W., Washington, D.C.

REGION IV —*Ohio, Indiana, Kentucky, West Virginia*
Regional Office, Commercial Arts Bldg., 704 Race St., Cincinnati, O.

REGION V —*Illinois, Michigan, Minnesota, N. Dakota, South Dakota, Wisconsin*
Regional Office, 209 LaSalle St., Chicago, Ill.

REGION VI —*Alabama, Florida, Georgia, Mississippi, S. Carolina, Tennessee*
Regional Office, Belle Isle Bldg., Atlanta, Ga.

REGION VII —*Arkansas Louisiana, Okla., Texas*
Regional Office, 609 Neil P., Anderson Bldg., Fort Worth, Texas

REGION VIII—*Iowa, Kansas, Missouri, Nebraska*
Regional Office, 2605 Walnut St., Kansas City, Mo.

REGION IX —*New Mexico, Colorado, Utah, Wyoming*
Regional Office, 7th floor, Exch. Bldg., 1030 15th, Denver, Col.

REGION X —*Arizona, California, Nevada*
Regional Office, 30 VanNess Ave., San Francisco, Cal.

REGION XI —*Idaho, Oregon, Montana, Washington*
Regional Office, 2005 Fifth Ave., Seattle, Wash.

Consistently Closer Duplication

MEANS CONSISTENTLY BETTER TOOL AND CUTTER SHARPENING

The extra effort Bay State makes to duplicate, on each order, exactly the specifications you have determined are right . . . pays off in cutting tool performance.

"Fractional grading"—an exclusive Bay State manufacturing method—offers a more precise selection of wheel hardness. Within the range of each regular grade, Bay State offers three fractional grades. Once you "fit the grade to the grind", you can be much more sure of duplicating exactly the wheel you want.

Also with Bay State grinding wheels, you get the advantages of Bay State's vitrified bond —an extra-strong bond that permits more open structures. Such wheels run cooler and faster. Other types of vitrified and resinous bonds are available for any need. Bay State's "Koolpore" gives you an extremely open and porous wheel — especially suited for cemented carbides.

Send for complete details and tables — ask for Bulletin F containing description of Bay State's 6A and 8A for production grinding of duplicate parts, and "Koolpore" extra-cool cutting wheels. Bay State offers a complete line of bonded abrasive products and individualized engineering service.

BAY STATE ABRASIVE PRODUCTS CO.
9 Union Street, Westboro, Mass.

BAY STATE ABRASIVE PRODUCTS

Top Performance Consistently Duplicated

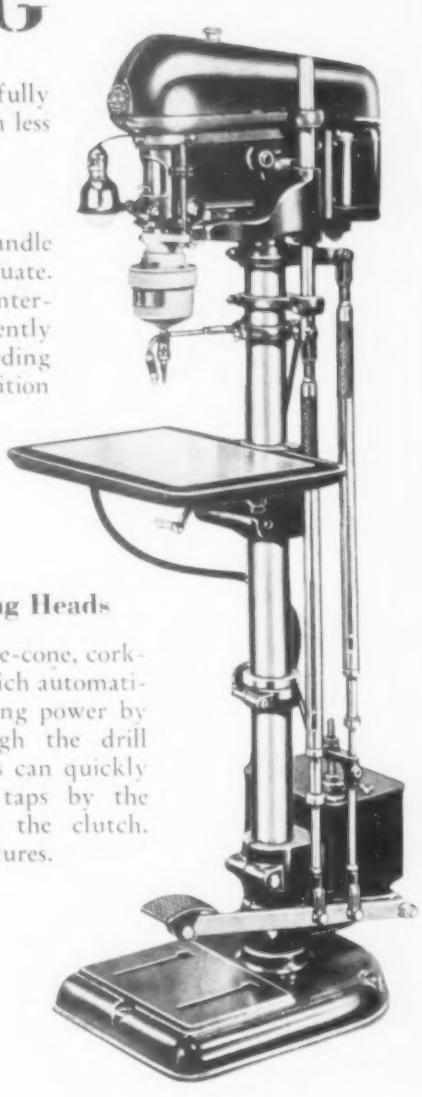
GRINDING WHEELS · HONING AND SUPERFINISHING STONES · PORTABLE SNAGGING WHEELS · MOUNTED WHEELS AND POINTS · CUT-OFF WHEELS · INSERTED-NUT DISCS AND CYLINDERS

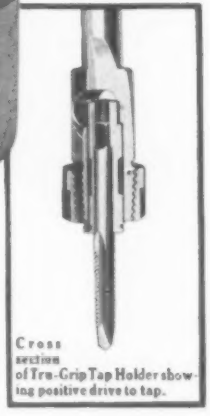
How Better Design makes for Better TAPPING

Every item in the Procunier line of tapping equipment has been skillfully designed so as to produce definitely faster, more accurate tapping with less tap breakage!

Procunier Universal Tapping Machines

offer: 1. Four speeds, ranging from 390 to 2050 RPM efficiently handle jobs for which conventional high speed tapping machines are inadequate. 2. One machine handles tap sizes from No. 2 to ½" through two interchangeable heads. 3. Extra long Spiral Compensating Springs conveniently located, with wide range hand screw adjustments, maintain preset feeding and reversing pressure INDEPENDENT OF OPERATOR. In addition these machines are so designed that they actually allow the tap to establish its own lead.





Cross section of Tru-Grip Tap Holder showing positive drive to tap.

Procunier Tapping Heads

Tap is driven by a double-cone, cork-faced friction clutch which automatically regulates tap driving power by pressure applied through the drill press spindle. Operators can quickly detect dull or loaded taps by the "feel" or pressure on the clutch. Many other special features.

Procunier Tru-Grip Tap Holders

are the lightest on the market—one-third the weight of conventional tap holders. Tap has positive drive through the square hole broached in the collet. The tap is held in true alignment by the round of its shank, and tap shanks are never scored or disfigured. Other features include: Wide range of tap capacity; one piece body and shank; accepts standard size taps.

Send for Bulletin

Send coupon for illustrated bulletins giving full details and prices on Procunier Universal Tapping Machines, High Speed Tapping Head and Tru-Grip Tap Holder.

PROCUNIER SAFETY CHUCK CO.
12-18 S. Clinton St.
CHICAGO

Procunier Safety Chuck Co.
12-18 S. Clinton St., Chicago, Ill.

Send me bulletins on: ☐ High Speed Tapping Heads. ☐ Tru-Grip Tap Holders. ☐ Universal Tapping Machines.

Name

Address

City

State

"MY PRE-WAR LATHES ARE STILL MECHANICALLY EFFICIENT"

But

How Will They Stack Up Against

LIPE *Carbo*-Lathes

After the War ?

Sure your pre-war lathes are still mechanically efficient. But that's actually a draw-back. Because you'll be facing a New Order of competition after the war. And if you don't plan to retool with lathes like the LIPE CARBO—with lathes that embody the vast fund of engineering knowledge and experience that has been developed in wartime production—you'll pay an excessive cost in unnecessary operations, men and floor space, even in jigs, tools, inspections and scrap.

Engineered for Carbide Tools

LIPE CARBO-LATHE was especially designed for the Higher speeds and heavier cuts of carbide tools. Extreme rigidity, plus the smoothness of worm-gear drive, insure freedom from torsional deflections, taper and out-of-round. Combined with 162 speed changes, these advantages give long tool wear, longer runs between re-grinds and low tool breakage. Works to tolerances that would have been considered "tight" for toolroom jobs before the war. Cuts range from 0.003" to 0.30". Swing over bed 12", between centers 18". Let us send you complete data and delivery dates.

LIPE-ROLLWAY CORPORATION, SYRACUSE 1, N.Y.

FAUVER

Hose Assemblies for Industrial Use

are TOUGH!

There's a Fauver combination for every industrial need—*no matter how tough.*

With their double reinforcing of woven steel piano wire, some are flexing thousands of times a day for months on end—and they're tough enough to withstand burst pressures to 25,000 lbs.

Solvent-proof Neoprene (synthetic) core and covering stand up against the disintegrating properties of petroleum products perfectly and help Fauver hose assemblies make good at 65° below zero and 225° above.

Fauver assemblies for low pressures and less strenuous service have no equal. For high pressures the fittings bite on under 100,000 lbs. pressure to STAY on.

Years of experience assure you our recommendations are based on positive knowledge as to what combinations will best do *your* jobs.

Ask For Complete Hose Catalog

TAILORED TO YOUR NEEDS

J. N. FAUVER CO.

53 W. Hancock Detroit 1, Michigan

DUAL ADJUSTABLE
Inserted-Blade Milling Cutters
for the exacting needs of
WAR PRODUCTION

TAPERED, serrated blades fit into mating slots in the cutter body. There they are immovably held without wedges, pins or set screws—yet may be quickly removed. As the slots are at an angle to the body, when these blades are set out one or more serrations, as required for regrinding, both radial and axial adjustments occur at the same time *automatically!* This not only saves time in moving the blades out into line of wear, but actually results in 65% blade usability.

LONGER BLADE LIFE DUE TO AUTOMATIC RADIAL AND AXIAL ADJUSTMENTS

The new blades and cutter bodies are available for either roughing or finishing. In the roughing cutter (above) the blades are inserted radially into the body and shear into the work in the direction of feed. Major wear and adjustment are on the periphery, the face of the blade merely scraping the work just cut.

In the finish milling cutter (left) the blades are inserted into the periphery and are ground with a slight lead to produce a "skiving" cut. Here the major blade wear and major adjustment are on the face. A folder describing the "Dual Adjustable" principle will be sent on request.

THE O K TOOL CO., SHELTON, CONN.

TRADE O K MARK **SYSTEM**

OF INSERTED-BLADE METAL CUTTING TOOLS

GADGETS

Ingenious Devices and Ideas to Help the Tool Engineer in His Daily Work

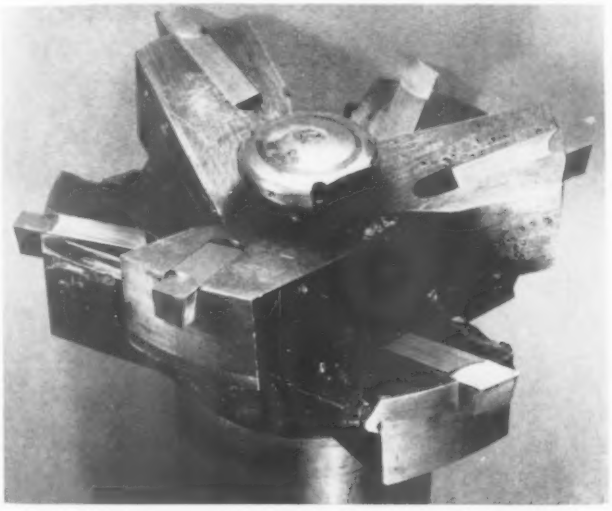
Two Operations in One

OF ALL-WELDED construction, this simple two-step core boring tool bores two diameters simultaneously.

While the tool should be dimensioned to suit the job, the one illustrated has a shank of 4" diameter x 14½" seamless tubing. This serves as a conduit for coolant, which is forced out through the holes in the plug shown at the front. In the opposite end—not shown—a solid stub is welded in and turned to the diameter of the turret holes.

The tool is sturdy and fabricating costs are low. Standard tool bits may be used. The use of tool bits has the advantage that one may experiment with high speed steels, cast metals or carbides until the best type of cutter is found.

V. Harisay, Montreal

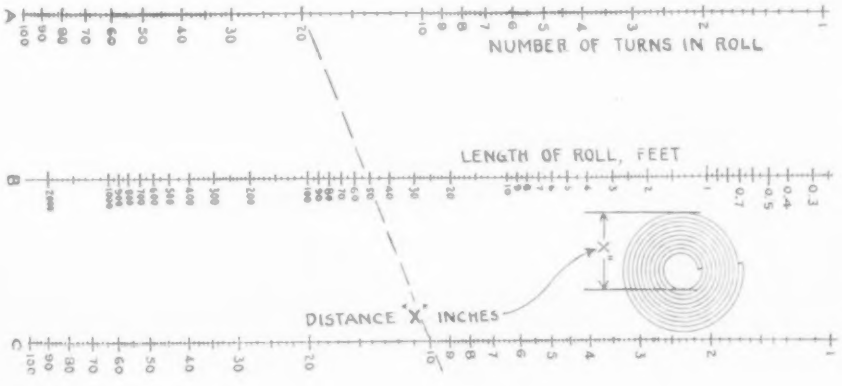


Measuring the Length of A Roll

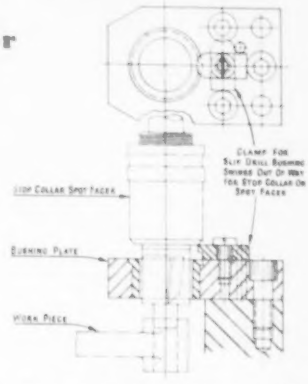
THIS CHART PROVIDES a quick means of determining the number of linear feet in a roll as of strip steel. Only one measurement is necessary—the distance "X" in inches. Then, count the number of turns in the roll. These factors determined, a rule laid across the chart, touching the two known points in the outside columns, will intersect at the number of feet shown in the center column.

For example, how many feet in a roll of 20 turns, the distance "X" being 10". As shown on the chart, the distance is just about 50 feet—close enough for practical purposes.

W. F. Schaphorst, Newark, N. J.



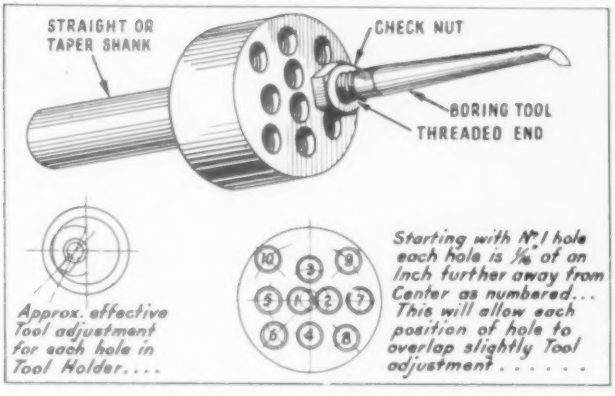
Swinging Clamp For Slip Bushings



THERE IS AN OCCASIONAL requirement for spot facing a boss to a given dimension while the work piece is still in the jig used for drilling and reaming the hole in the boss. In order to hold the finish to the required dimension an adjustable stop collar spot facer is used. However, it is usually found that the lock screw for the slip bushing would interfere with the stop collar on the spot facer. To eliminate this interference the writer has found that a swinging clamp of the type shown can be substituted for the bushing lock screw.

When the slip bushing is in place, the clamp is in the position shown with the torque thrust taken against a stop pin near the outer end of the clamp. The action of turning the slip bushing to remove it, results in the clamp being turned to the dotted position which provides the necessary clearance for the stop collar on the spot facer to contact the face of the liner bushing, thus holding the desired dimension on the work piece. Use of the shoulder type liner is recommended in order to withstand the thrust of the stop collar.

W. Z. Fidler, Rock Island, Ill.



Wide Range Adjustable Boring Tool

ILLUSTRATED ABOVE is a simple boring tool of wide range, which can be made in any desired size. As shown, the body has a series of staggered, tapped holes, each progressively farther from the center. The threaded boring tool is inserted in the desired hole and when adjusted is locked with a check nut. The shank of the body may be straight, for use in a chuck or collet, or tapered to suit machine spindle.

Walter Pohle, Boston

36 pages of... HEAT TREAT ★ DATA ★

This entirely new 36 page catalogue is now ready for distribution. Valuable, up-to-the-minute information is presented on Park Salt Baths, Carburizing Compounds, Quenching and Tempering Oils and Protective Coatings. Included also are useful charts illustrating case depths obtained at various times and temperatures in Park's liquid and solid carburizers. Please enter your request on your company letterhead today.

WRITE TODAY!

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PARK CHEMICAL CO.
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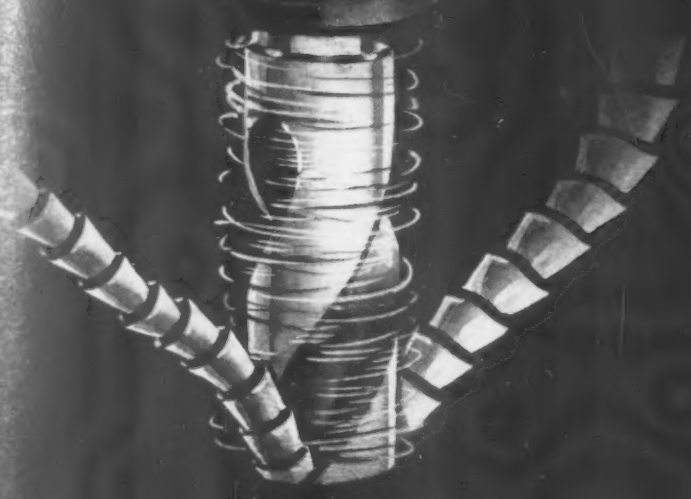
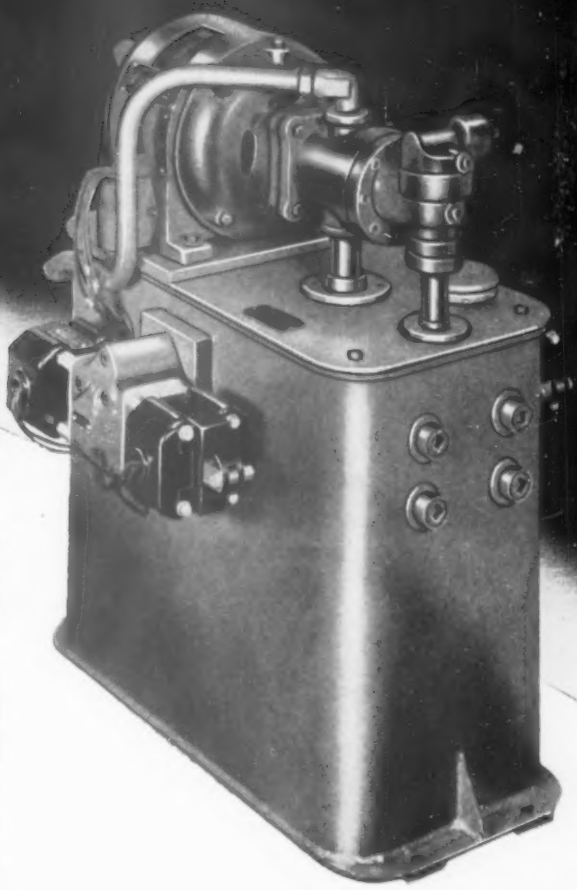


Hydraulics—

COMPLETELY ADAPTABLE TO ANY MOTION DESIRED

"Hy-Mac" Hydraulic Power Units can be applied to drilling, grinding, milling, boring, piercing, riveting, broaching, pressing . . . just determine the functions of the machines that are to be hydraulically operated—and our engineers will recommend a Power Unit and a layout of circuits to best do the job . . . For feed and traverse of multiple or single tools . . . for indexing and locating . . . for clamping, etc., all or any of the movements and in any combination, can be adapted to HYDRAULICS . . . Any designer or builder of machines can accommodate their specific design, either partially or completely to "HY-MAC" HYDRAULICS . . . and our modern plant, together with a comprehensive engineering department is completely competent to handle all of the technical planning, designing, and detailing in connection with building of hydraulic and specific-purpose machinery . . . Our engineers will be glad to make recommendation and preliminary proposal without obligation.



8444-Unit for actuating and controlling a simple feed circuit which incorporates rapid traverse, adjustable feed and rapid return of a single slide —primarily for drill press type of operation but can also be used for the control and actuation of a press or any machine where only one slide is to be controlled.

HYDRAULIC MACHINERY, INC.

12825 FORD ROAD • DEARBORN, MICHIGAN

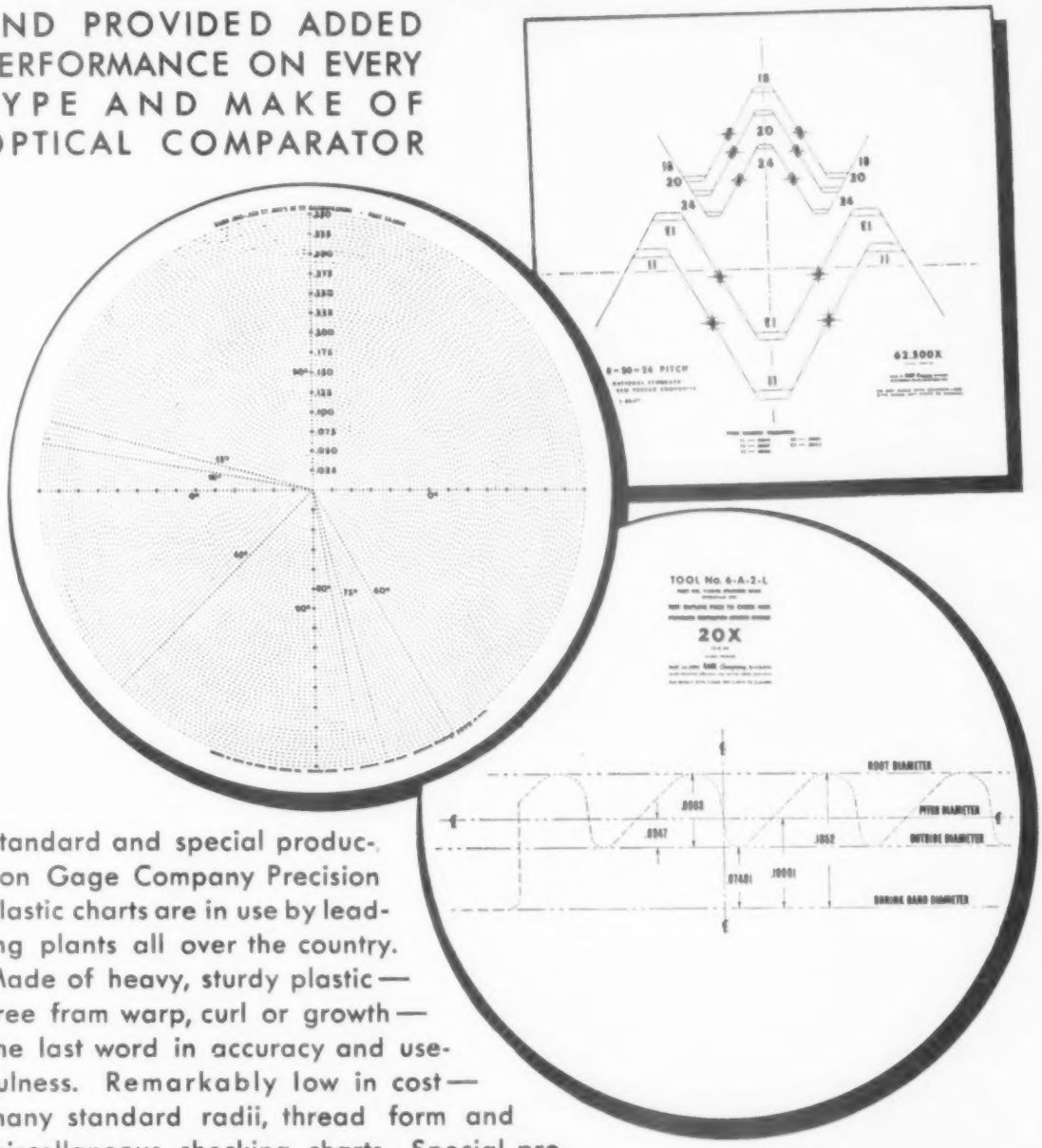
HYDRAULIC MACHINERY—WESTERN DIVISION, 1105 PACIFIC AVE., GLENDALE 2, CALIFORNIA

GAGE COMPANY

Precision PLASTIC COMPARATOR CHARTS

....have reduced inspection costs...

AND PROVIDED ADDED PERFORMANCE ON EVERY TYPE AND MAKE OF OPTICAL COMPARATOR



Standard and special production Gage Company Precision Plastic charts are in use by leading plants all over the country. Made of heavy, sturdy plastic — free fram warp, curl or growth — the last word in accuracy and usefulness. Remarkably low in cost — many standard radii, thread form and miscellaneous checking charts. Special production charts constructed to order, afford maximum comparator use and reduce inspection costs.

FREE CHART DESIGNING SERVICE

WRITE FOR FULL PARTICULARS

GAGE COMPANY DIVISION

BATTLE CREEK · MICHIGAN

Peace terms every man should make NOW!

The war is still on . . . and will be for some time to come.

But right now—before the war ends—every man in America has an unprecedented opportunity to make terms with himself for his own peace . . . his peace of mind.

For *now*, as never before, a man should look at his wife and family and say, "What can I offer them for the future?"

Now, as never before, a man should look at his house and worldly goods and say, "How can I improve these so my family may better enjoy life?"

Now, as never before, a man should look at tomorrow and say, "How can I best prepare for some unforeseen emergency which might affect my family?"

And *now*, as never before, every man in America has a chance to answer all these questions—an opportunity to provide for the future.

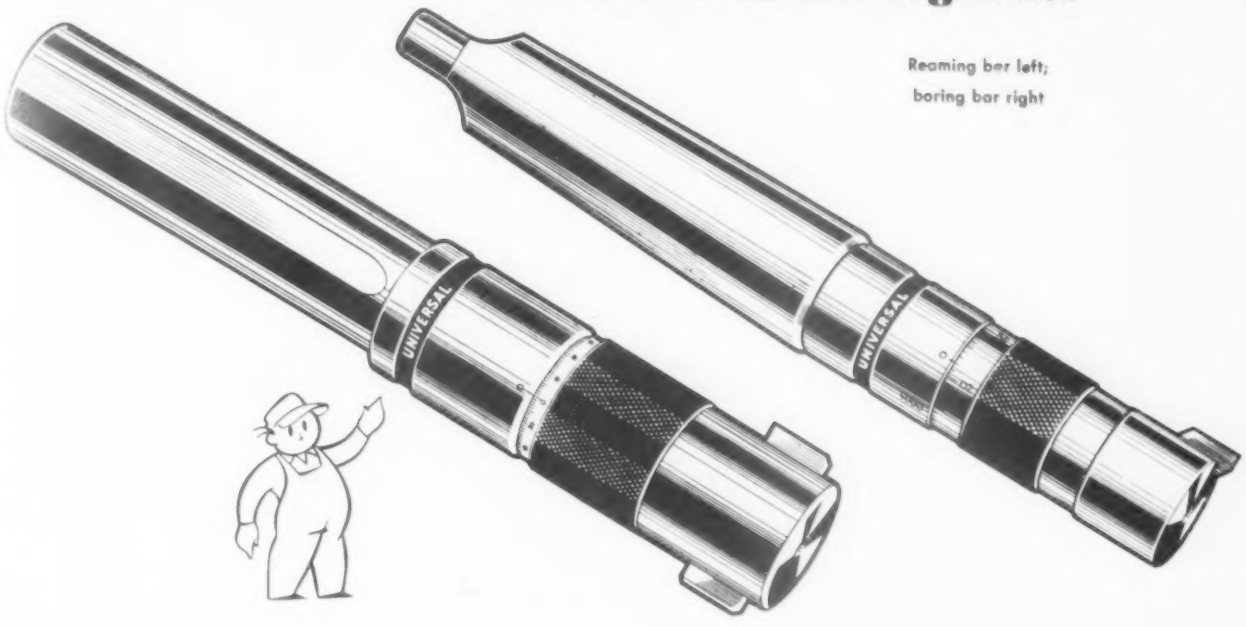
That opportunity is War Bonds. No doubt you are buying War Bonds through the Payroll Saving Plan. Arrange to buy *more* War Bonds. All you can afford. *More* than you thought you could afford.

What's even more important—don't cash in those War Bonds before they mature. Stick them away in a safe place—and forget about them till you can reap the full harvest on them.

Now is the time to make your plans for peace of mind. It's something you owe yourself . . . owe your family. Buy War Bonds and hold onto them!

ASTE **American Society of Tool Engineers**

Universal Mikro-Lok Boring Bars for Accurate Finishing Cuts



Reaming bar left;
boring bar right

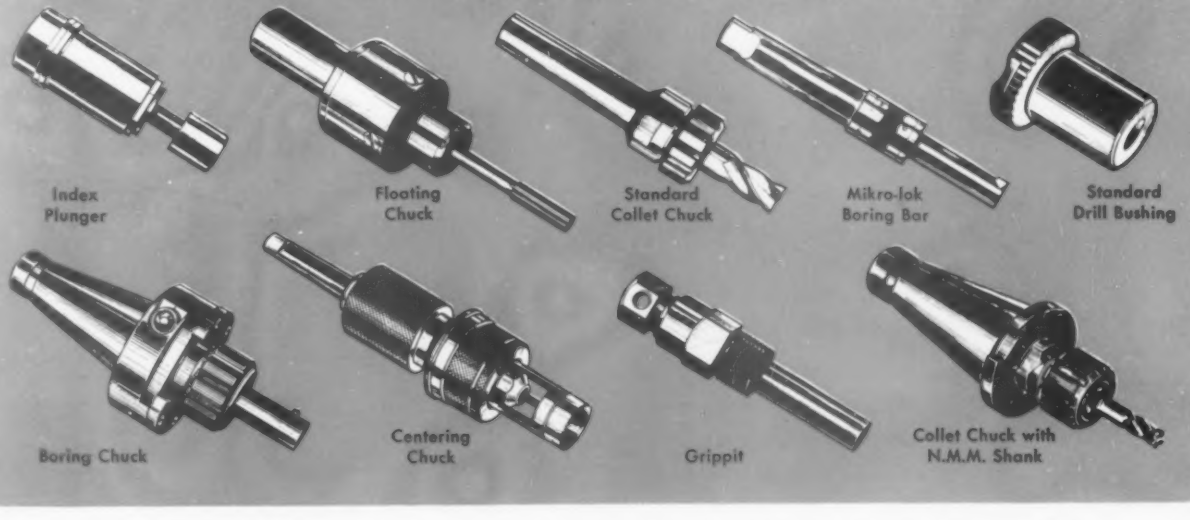
Universal Mikro-lok boring and reaming bars are the perfect tools for finishing cuts with extreme accuracy. They are especially adapted to boring to a shoulder, or to the bottom of a hole or for taking intermittent cuts.

A micrometer-like dial, easily and quickly adjusted, operates a unique mechanism which accurately sets the tool cutting edge to the required size. You can depend on the micrometer graduations to within .0005 inches. Rigid construction protects its accurate adjustability.

Universal Mikro-lok boring bars may be used effectively for light roughing cuts, semi finishing, and finishing cuts in one set-up. Available singly or in sets with Morse taper shanks or Swiss tapers for Jig Boring Machines, and special shanks and flanges for Diamond Boring Machines or other applications. Prompt delivery.

Write for information about these or any of the other Universal precision tools illustrated here.

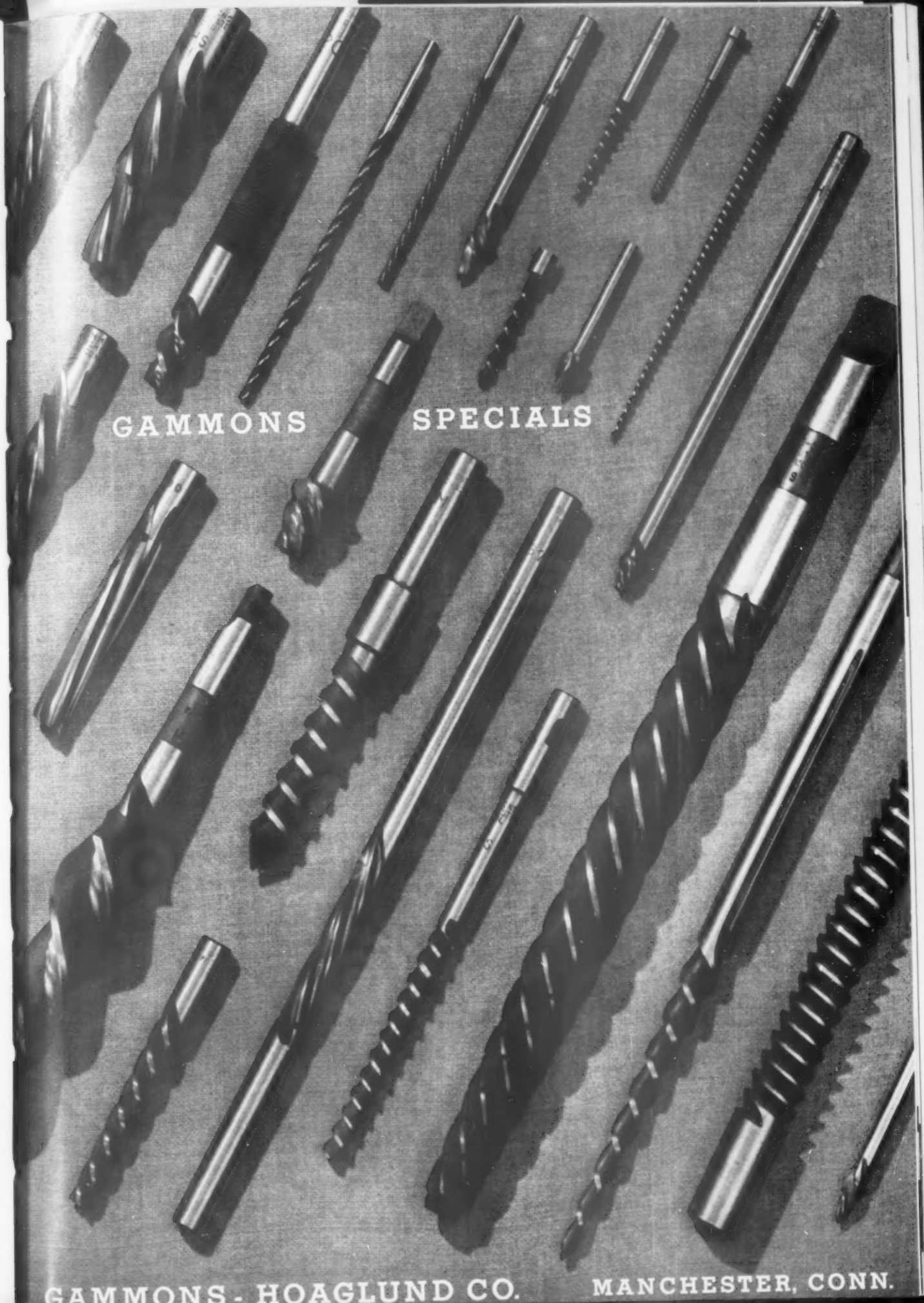
UNIVERSAL TOOLS THAT WILL INCREASE PRODUCTION AND ACCURACY IN YOUR PLANT



UNIVERSAL ENGINEERING COMPANY

FRANKENMUTH, MICHIGAN

FIGHTER PLANE GIVEN BY EMPLOYEES — 20% EMPLOYEES BOND DEDUCTIONS

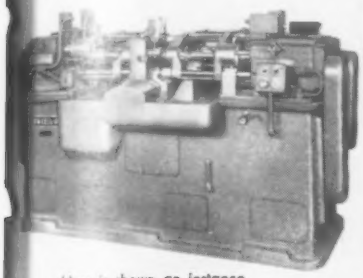

GAMMONS SPECIALS
GAMMONS - HOAGLUND CO.
MANCHESTER, CONN.

Index of Tool Engineer Advertisers

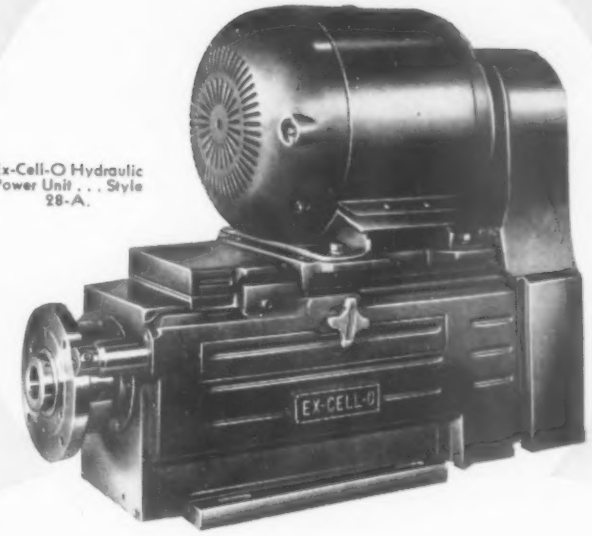
February, 1945

XLO

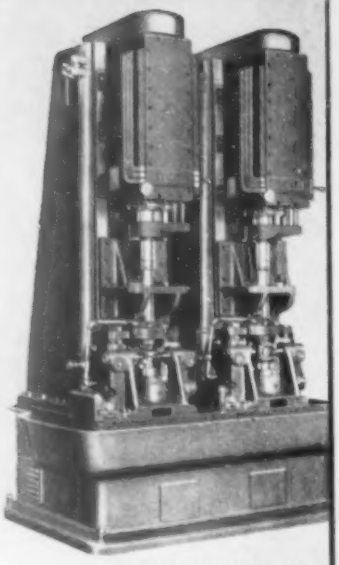
EX-CELL-O *for* PRECISION



Here is shown an instance where the Ex-Cell-O Small Hydraulic Unit (Style 21) is used on a machine for the accurate drilling of holes in oil pump bodies.



Ex-Cell-O Hydraulic Power Unit . . . Style 28-A.



On this Ex-Cell-O double drill press, two Style 25-A Ex-Cell-O Hydraulic Units are mounted on the columns in vertical position. This has definite advantages on certain classes of work.

Design for
ECONOMICAL PRODUCTION!

Production Machines equipped with Ex-Cell-O Hydraulic Units have numerous advantages

For the machine you build, or the machine we build, the use of Ex-Cell-O Hydraulic Power Units provides these features:

They are compact, for proper design.
They are self-contained, for ease in installation.
They have infinite feeds, for proper cutting.
They have gear change, for proper speeds.
They have ample power, for multiple-head operation.
They have variable stroke, for greater flexibility.

Ex-Cell-O Hydraulic Power Units are standard and produced in quantities, but in nearly every case where the unit is used it becomes a part of a special, high production type machine for a specific operation. These units are economical because, as applications change, the units can become a part of the new machine even though entire base is redesigned.

The units can be mounted on any plane—horizontally, vertically, or angularly—on a temporary or a permanent base, and they can be arranged so that it is possible to use them in connection with guide bars and multiple drill heads.

Find out today how Ex-Cell-O Special Machines and Ex-Cell-O Hydraulic Power Units can fit your program for today's and tomorrow's production.

Where high production, accuracy, and economy through multiple operations are required—consult EX-CELL-O now

EX-CELL-O CORPORATION
DETROIT 6, MICHIGAN

SPECIAL MULTIPLE WAY-TYPE PRECISION BORING MACHINES • SPECIAL MULTIPLE PRECISION DRILLING MACHINES • PRECISION THREAD GRINDING, BORING AND LAPPING MACHINES • BROACHES AND BROACH SHARPENING MACHINES • HYDRAULIC POWER UNITS • GRINDING SPINDLES • DRILL JIG BUSHINGS • CONTINENTAL CUTTING TOOLS • TOOL GRINDERS • FUEL INJECTION EQUIPMENT • R. R. PINS AND BUSHINGS PURE-PAK PAPER MILK BOTTLE MACHINES • AIRCRAFT AND MISCELLANEOUS PRECISION PARTS

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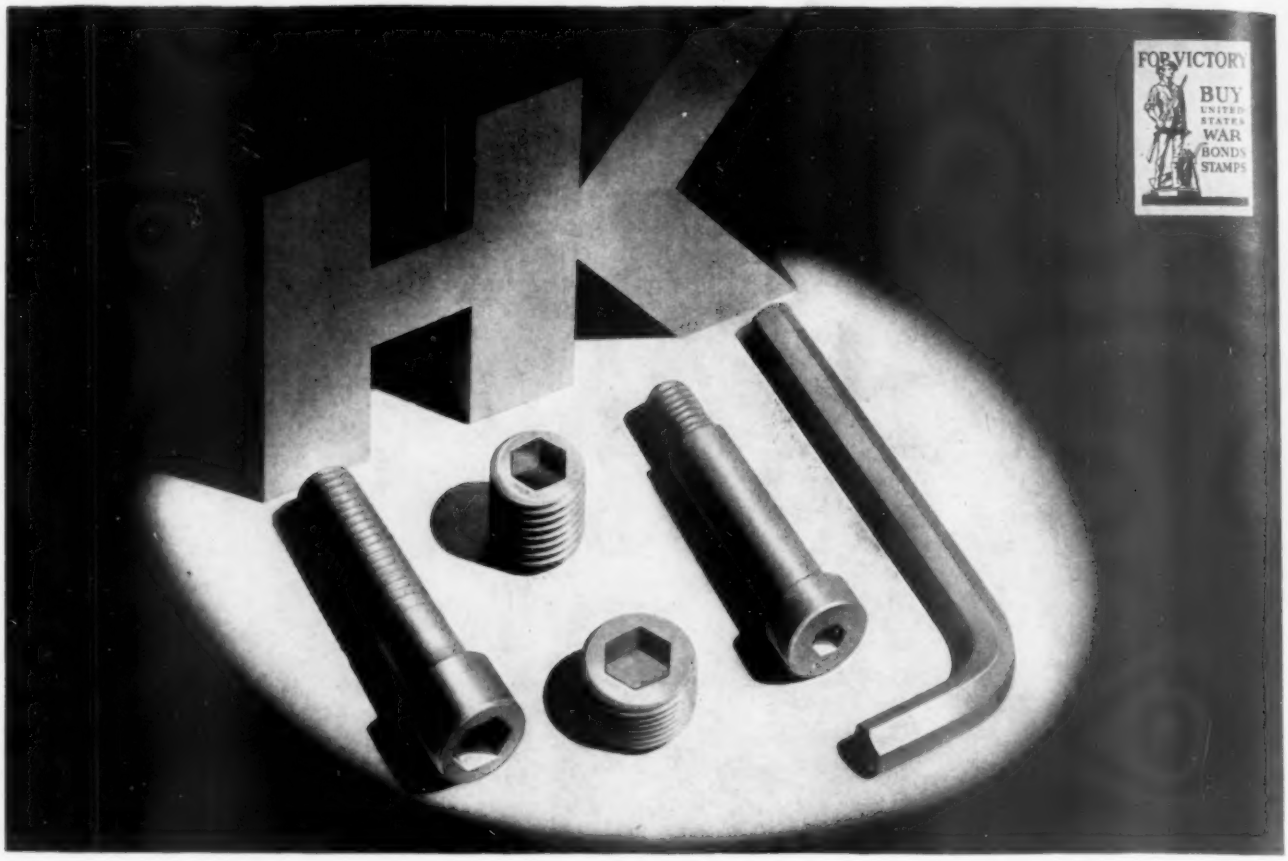

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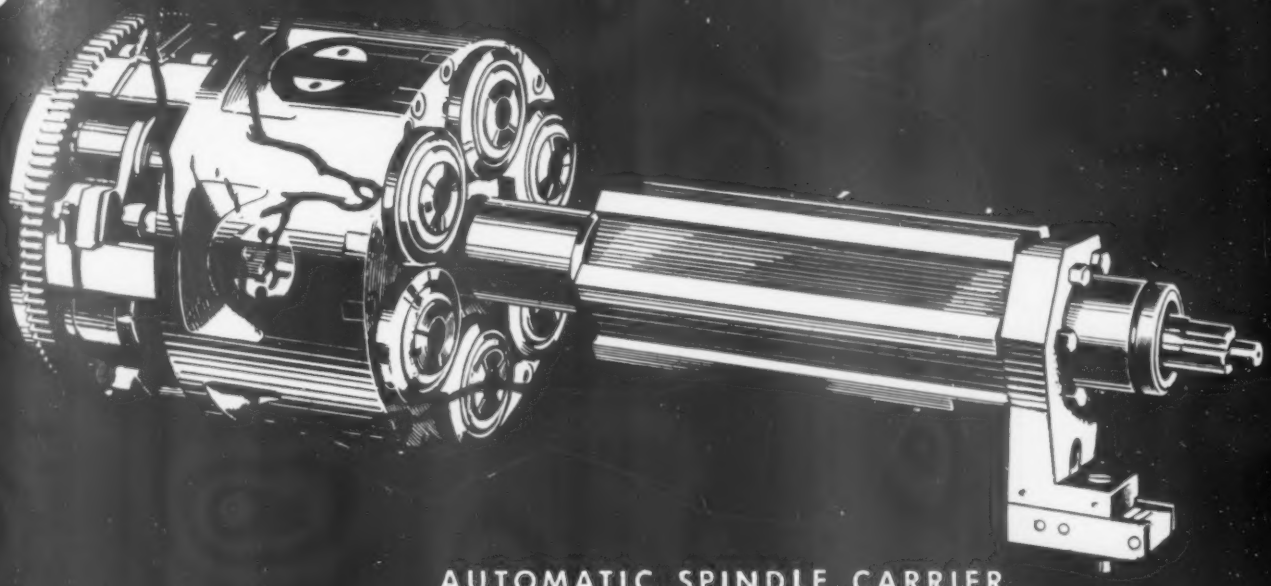
Exclusive

WITH NEW BRITAINS



AUTOMATIC SPINDLE CARRIER
LIFTING DEVICE

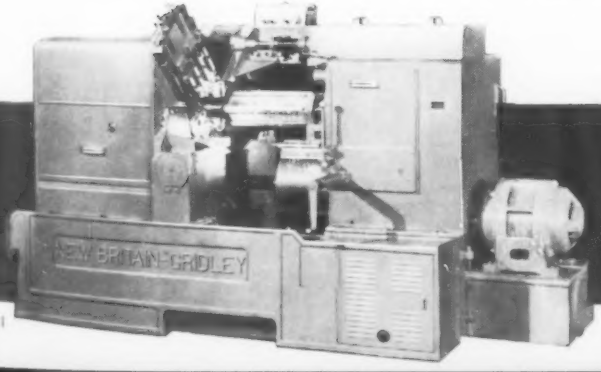
PRESERVES THE INITIAL ACCURACY

New Britains stay on the job ... producing untold quantities of fuse bodies, bullet cores, projectiles and other essential components of war materiel for ultimate victory. These Trojans of the Machine Age, employing exclusive features, assure accurate production without frequent adjustment and downtime.

The automatic carrier lifting device is but one of the many outstanding New Britain engineering feats in the world of automatics ... eliminating destructive wear ... providing permanent accuracy and long life.

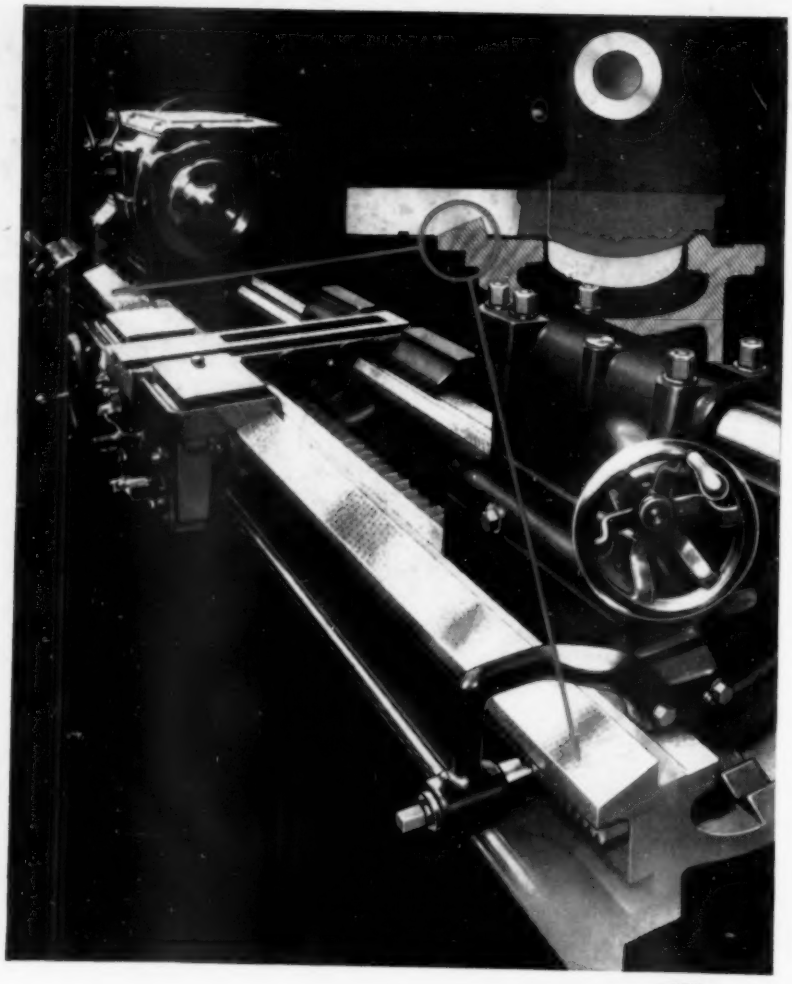
Should you be confronted with a production or service problem, look to the New Britain engineer in your area for the automatic solution.

New Britains produce more ... better and faster ... for less.



THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN, CONN.
NEW BRITAIN-GRIDLEY MACHINE DIVISION

A-01001



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WHY A COMPENSATING FRONT VEE?

On a LeBlond lathe, the front of the carriage slides on a Compensating Vee guide or way. One side of it is machined to provide an angle of 15 degrees, the other an angle of 70 degrees. This 70 degree side is fully three times as wide as the usual inverted Vee way. The 15 degree side serves a double purpose. It presents a surface at right angles to the thrust of the tools, preventing any tendency of the carriage to bind or climb, even under the heaviest cuts. Secondly, it compensates for wear of both the carriage and bed ways.

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